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1980 Animal Science Research Progress Report

University of Tennessee Agricultural Experiment Station

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1980 ANIMAL SCIENCE RESEARCH PROGRESS REPORT

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DEPARTMENT OF ANIMAL SCIENCE

FOREWORD

Please accept with our compliments the 1980 Animal Science Research Progress Report. These abbreviated reports will acquaint you with many of our research efforts. Many of our projects are not reported on each year so review other years' reports for other areas of research. Much of this information will ultimately appear in more detailed Experiment Station publications and journal articles but if you need additional information on topics, feel free to contact the authors.

Our research program is directed toward the problems of animal agriculture in Tennessee and the nation. It would not be possible, however, without the continued cooperation of the legislature and the livestock and agribusiness industry. We are thankful for that support.

While we are having difficult years financially in Tennessee, there are several positive items worthy of mention to you. This year's report reflects the continually increasing input of the College of Veterinary Medicine personnel into our research in animal health and physiology. This is a unique feature of animal science in Tennessee. We are proud to report that many of our faculty and graduate students gave excellent presentations of research progress at several scientific meetings this past year. You can be justly proud of the way they represented the University of Tennessee.

Several new faculty have been added within the past two years. These include Dr. Henry Kattesh (Ph.D. at VPI) in swine physiology, Dr. Kelly Robbins (Ph.D. at University of Illinois) in poultry nutrition, and Dr. Richard Heitmann (Ph.D. at University of Maine) in ruminant nutritional physiology. A complete faculty listing appears in the back of this publication. Critical faculty needs exist in the areas of dairy management and poultry management.

We opened a new research facility in January, 1981, at the Plateau Experiment Station to study management practices of newly purchased feeder pigs. Swine facilities at UT Martin have been remodeled and modernized. A swine confinement breeding and gestation building has been built at the Ames Plantation and is now occupied. A new calf barn was completed at the dairy unit at the Middle Tennessee Experiment Station. The milking parlor at the West Tennessee Experiment Station was remodeled. We have embarked on one of the most revolutionary studies in the country on genetic-nutritional environment interactions in beef cattle. Unfortunately, we also have to report continued delays in funding a badly needed new poultry unit, remodeling needed in the swine and beef facilities at Blount Farm, and remodeling and repair in Brehm Animal Science building facilities.

All factors considered, however, we will have another productive year in research in 1981. We look forward to sending you this report next year.

Ronald R. Johnson
Professor and Head

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MISCELLANEOUS

EFFECTS ON PREGNANT BEEF COWS PLASMA Ca, Mg AND K AND ON CALF VIABILITY FROM VITAMINS A, D AND E INJECTIONS

L. K. West, M. C. Bell, D. D. Howard, R. Q. Snyder, J. Martin and G. Lambert

Blood samples were taken from 358 pregnant beef cows at three different experiment stations to determine the effect of vitamins A, D and E injections on plasma minerals and on calf viability. Injections were made between December 11 and December 18. Half of the cows were injected with a solution containing 4.5 million I.U. of vitamin A, 675,000 I.U. of D_3 and 450 I.U. of E, while an equal number of cows were injected with the same volume of physiological saline. Calves born to the injected cows were scored on viability ranging from 0 being a healthy calf and 5 being a dead calf. Forage samples taken when blood samples were obtained at the three stations were analyzed for β carotene.

1. Blood samples drawn from the cows immediately prior to the injection, 24 hours later and 28 days later showed no difference in their means due to treatment; however, location differences were found in Ca 11.15 $\pm$ .09 mg/100 ml and Mg 1.92 $\pm$ .04 mg/100 ml at Alcoa location compared to Ca 10.88 $\pm$ .01 mg/100 ml and Mg 2.28 $\pm$ .03 mg/100 ml at Crossville (Table 1).

2. Mean β carotene values of forage samples from the three stations did not differ greatly (Table 1).

3. An equal number of dead calves (7) were observed in both the vitamin and saline injected groups, but healthy calves were slightly higher in the saline injected group and weak calves were more numerous in the vitamin-injected group (Table 2).

Table 1. Station effects on plasma Ca, plasma Mg and on forage carotene

	Plasma-mg/100 ml		Plasma mg/100 ml	Forage mg/kg
Station	Ca	Mg	K	β carotene
Crossville	10.88 ± .01	2.28 ± .03	19.48 ± .23	1.958 ± .677
Greeneville	10.72 ± .11	2.15 ± .03	19.85 ± .24	2.529 ± 1.709
Alcoa	11.15 ± .09	1.92 ± .04	19.68 ± .29	2.848 ± 1.554

Table 2. Viability of calves at birth as affected by injections into beef cows

	Injections	
Calf score	Saline	Vitamin
0 = healthy calf	139	126
1 = minor calving problem	4	6
2 = weak calf	12	21
3 = weak calf and minor calving problem	0	1
4 = weak calf and mechanical birth assistance	4	4
5 = dead calf	7	7
Total	166	165

EFFECT OF K PASTURE FERTILIZATION ON METABOLISM OF Mg, Ca AND K IN LACTATING BEEF COWS

D. L. Hodge, M. C. Bell and Gayle Lambert

It has been suggested that high dietary intake of K can lead to a greater incidence of grass tetany (Perason et al., 1949). Since that time research has produced varied results. Grass tetany is a disease or disorder that is characterized by a subnormal level of plasma magnesium. It usually affects older beef cows during early lactation that are on lush pastures in late winter and early spring. The objectives of this research were to determine what effects high K fertilization of fescue pastures had on plasma levels of Mg, Ca and K and on the metabolism of Mg, Ca and K in beef cows.

During the months of February and March, 1980, a balance trial was conducted with lactating Angus and Hereford cows grazing fescue pasture. The treatments consisted of two recently eatablished pasture areas of approximately 4 ha, each of which were fertilized with 112 kg of N and 169 kg of P per ha. The internal (acid-detergent lignin) - external (Cr_2O_3) indicator technique was used to determine fecal dry matter output and dry matter consumption of the cows. Urine volume was estimated using creatinine ratios. Milk production was estimated by the calf-suckle technique. Pasture samples were collected every 3-4 days.

1. No grass tetany signs were exhibited in any cows although three became hypomagnesemic on high K pasture and one on the control pasture.

2. The K fertilized pasture had a higher crude protein ($P<.1$) and K content than the control pasture ($P<.01$).

3. The control pasture had a higher Ca content ($P<.05$) and both pastures had heavy weed infestation consisting primarily of turnip greens.

4. Both %K x %CP and $\frac{K}{Ca + Mg}$ ratio were significantly increased ($P<.01$) by K fertilization.

5. Cows on +K pasture had a significantly lower DM intake than the cows on control pasture ($P<.05$)

6. Urinary excretion of Mg and Ca was lower in the +K cows ($P<.05$).

Table 1. Percentage forage analysis during collection period

Variable	Pasture treatment	
	Control	Added potassium
No. animals	11	12
Calcium	1.22	.97
Magnesium	.24	.27
Potassium	2.26	3.03
ADF	21.16	21.56
CP	20.69	22.60
%CP x %K	46.51	68.41**
$\frac{K}{Ca + Mg}$	1.64	2.57**

**P<.01.

Table 2. Daily balance of magnesium and calcium in grams (± S.E.M.)

Item	Pasture treatment		Pasture treatment	
	Control	+K	Control	+K
	Magnesium		Calcium	
Intake	9.69	8.44	48.48	34.71
	.54	.46*	2.67	2.45**
Excretion				
Fecal	7.88	6.11	33.93	23.25
	.47	.29**	1.76	1.02**
Urinary	.45	.20	.31	.22
	.05	.03**	.04	.02*
Milk	.30	.30	3.51	3.64
	.01	.01	.14	.17
Balance	1.05	1.82	10.73	7.60
	.42	.31	2.12	1.98

*P<.05, **P<.01

IN VITRO FUNCTION OF BLOOD PLATELETS FROM HYPOMAGNESEMIC COWS[1]

J. K. Miller, M. D. Schneider, M. C. Bell and N. Ramsey

The similarity between arteriosclerotic lesions in humans and vascular lesions in Mg-deficient calves was recognized over 40 years ago, but this knowledge has not been related to the problem of hypomagnesemia in ruminants. Adhesion of blood platelets to collagen exposed by damage to the vascular endothelium is followed by activation of platelets with swelling, then contraction and release of specific platelet constituents, and aggregation. Unstable metabolites of constituents released by activated platelets may predispose vascoconstriction and thrombus formation. The objective of this report was to compare *in vitro* function of platelets from normal and hypomagnesemic cows.

Twelve hypomagnesemic cows, selected from two groups fed fescue pasture or hay fertilized heavily with nitrogen and potassium, were compared with twelve control cows receiving orchard grass hay. Blood was assayed for hemotological profiles and Mg, Ca and K in plasma and erythrocytes. *In vitro* platelet function was measured turbidimetrically in platelet rich plasma using a platelet-active burro aorta collagen preparation.

1. Cows fed "tetanigenic" forage had lower plasma concentrations of both Mg and Ca than controls (Table 1). Mg and Ca concentrations also averaged lower in erythrocytes of hypomagnesemic cows but the differences were not statistically significant. The high K content of "tetanigenic" forage did not appear to influence K concentrations in either plasma or erythrocytes.

2. No treatment differences in numbers of erythrocytes, leukocytes or platelets were found.

3. Contrary to expectation, *in vitro* function of platelets was lower for hypomagnesemic cows than for controls as indicated by reduced velocity and intensity of aggregation in response to activation by collagen.

4. These results suggest that *in vitro* function of platelets, by itself, may not be an adequate measurement for comparing platelet function in normal and hypomagnesemic cows. Results do not establish whether platelets were also hypoactive *in vivo* or whether initially hyperactive platelets were activated *in vivo* thus reducing reactivity of platelets available for *in vitro* testing.

[1]Supported by U.S. Department of Agriculture Grant No. 901-15-168.

Table 1. Cell number, mineral content and *in vitro* function of platelets from blood of normal and hypomagnesemic cows.

Measurement and collagen concentration	Normal		Hypomagnesemic		
	Mean	SE	Mean	SE	P
Blood minerals (mg/100 ml)					
Plasma					
Magnesium	1.84	.09	.88	.15	.01
Calcium	9.18	.32	8.40	.27	.10
Potassium	15.73	.60	15.01	.72	NS
Erythrocytes					
Magnesium	1.44	.09	1.29	.10	NS
Calcium	2.21	.23	1.86	.19	NS
Potassium	86.63	2.96	82.46	3.41	NS
Blood cell numbers					
Erythrocytes (x 10^6/ul)	5.9	.2	5.6	.2	NS
Leukocytes (x 10^3/ul)	7.4	.5	6.4	.6	NS
Platelets (x 10^3/ul)	521	31	583	44	NS
Platelet aggregation delay time (sec)					
ug collagen					
160	20	1.2	22	1.1	NS
80	20	1.5	20	1.1	NS
16	28	2.1	26	1.4	NS
2	58	5.2	61	5.4	NS
Velocity of aggregation (%/min)					
ug collagen					
160	128	13.4	114	17.1	NS
80	135	9.2	118	12.5	.05
16	109	6.5	91	5.2	.01
2	65	6.0	55	5.6	.05
Intensity of aggregation (%)					
ug collagen					
160	90	1.8	84	2.5	.05
80	96	.9	88	1.6	.01
16	95	1.1	87	1.7	.01
2	83	2.5	77	2.8	.05

CLEARANCE OF EXOGENOUS STEROIDS IN ELECTROEJACULATED BOVINE SEMEN

J. D. Smalling, W. A. Lyke and H. Eiler

The composition of the uterine environment and the physiology of the uterine wall is critical in the process of reproduction. Recent findings in our laboratory indicated that exogenous steroidal hormones (estradiol, progesterone, testosterone and cortisol) are transferred readily from the circulatory system to the semen at normal (artificial vagina) ejaculation in the bull. This opens the possibility that (1) fertility could be altered by the chemical composition of semen, and (2) that the study of the clearance rate of specific substance may be used as accessory gland function test. The objective of this work was to study the clearance rate of exogenous steroidal hormones in the electroejaculate of bulls.

1. Different groups of bulls were injected (i.v.) with either estradiol (E_2), progesterone (P_4), cortisol (C), or testosterone (T) (approximately 100 mg each). In addition, another group of bulls received E_2, P_4, T and C blended at the same levels.

2. Bulls were electroejaculated at 20, 40, 60, 120 and 200 minutes after injection time.

3. Semen concentrations of all steriods studied were larger at 20 minutes than at any other time (Figure 1). The concentration of steroid in semen was cortisol, estradiol and testosterone, and progesterone in the same order (Figure 1). Concentration of steroids in the electroejaculate seems to be significantly less than that obtained by artificial vagina collection.

4. The injection of several steroids simultaneously created interference, probably competition, in the transfer of steroids to the ejaculate.

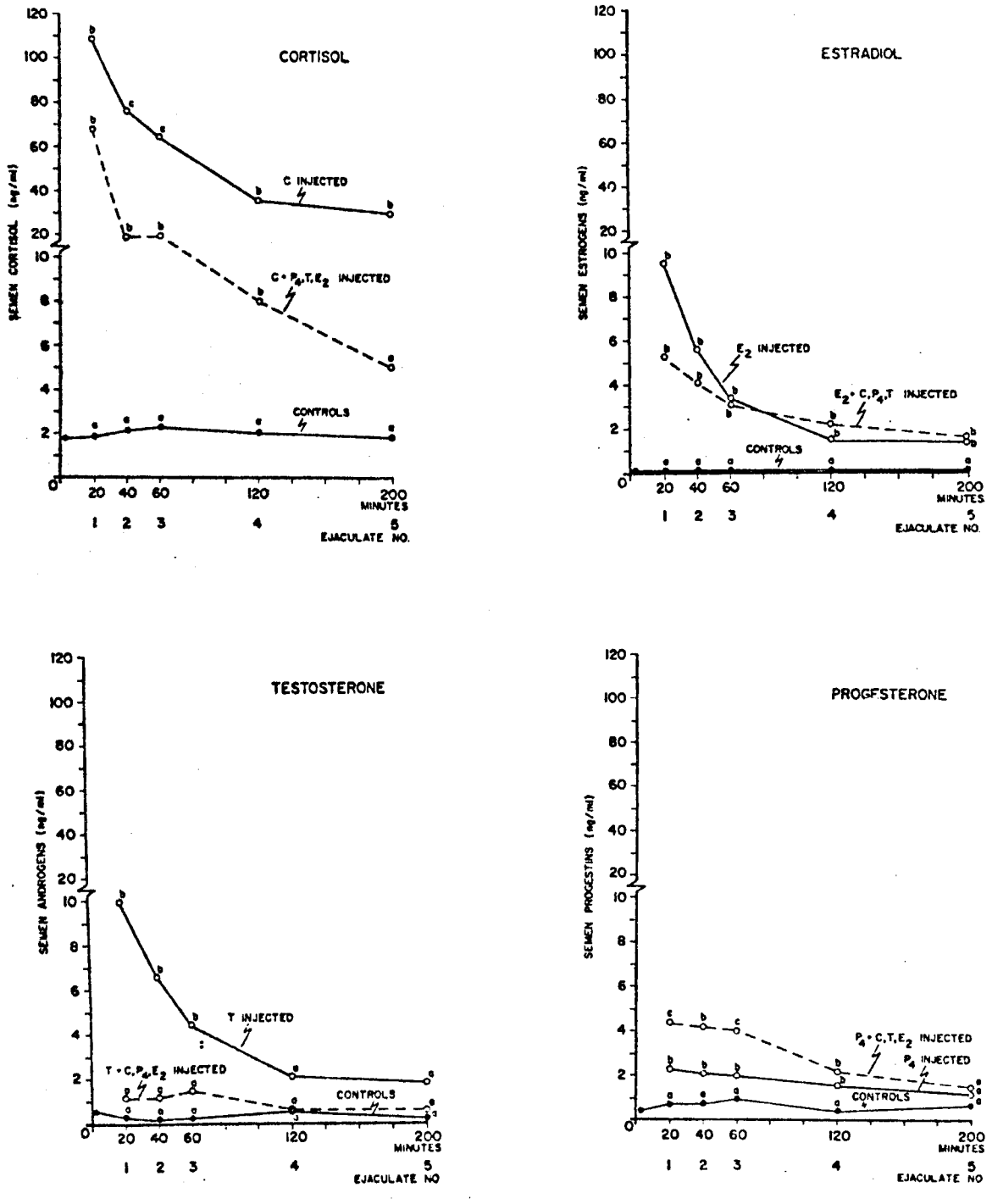

Figure 1. Semen concentration of steroids as function of time. Bulls received either cortisol (C), estradiol (E_2), testosterone (T) or progesterone (P_4) (I.v. injection). Another group of bulls received C,E_2, T, P_4 in a single injection. (a,b,c) Different superscript indicates significantly ($P<0.05$) difference as compared to controls at the same time period.

MARKET-TRANSIT CHANGES AND FEEDLOT ADAPTATION OF TENNESSEE FEEDER CALVES

J. B. McLaren, L. M. Safley, W. S. Damron and P. K. Su

The effects of market-transit stresses, exposure to pathogens and the resulting shipping fever complex, which slows feedlot adaptation, are recognized as major problems associated with moving Tennessee feeder calves from the farms where they are raised to finishing facilities (Cole et al., 1978; Billingsley, 1979). In general, Tennessee feeder calves are marketed at weaning. They are delivered by the producer where they are penned in close confinement (8 to 12 ft^2/calf) without feed and water for 18 to 36 hours (average = 24 hr). At the auction-barn, most calves are purchased by orderbuyers who haul the calves to their barns (50 to 300 miles) where they remain for 1 to 14 days (average = 72 hr). Each calf is allowed 20 to 30 ft^2 of pen space and fed hay free choice. They are then loaded on trucks and hauled for 18 to 36 hours (700-1500 miles) to cornbelt or western feedlot or to wheat pastures. In this trial 27 calves were purchased from each of two Tennessee feeder-calf producers, subjected to normal auction-barn (24 hr) and orderbuyer-barn (72 hr) environment at the Algood Livestock Barn, exposed to Infectious Bovine Rhinotracheitis (BVD) and hauled (18 hr) to a feedlot at the Highland Rim Experiment Station. At the feedlot, they were fed corn silage free-choice plus limited concentrate (1.5% of body weight). Numerous physiological changes occuring during the market-transit phase and feedlot adaptation were measured. The values for these parameters at various points in the market-transit chain and during feedlot adaptation are presented in table 1. These values are percentages of the respective parameter values when the calves arrived at the auction-barn.

1. Auction-barn weight loss was 6.2% of the purchase (arrival-auction-barn) weight (33 lb). However, 60% of the auction-barn weight loss was regained at the orderbuyer-barn. Calves weighed 7.5% less (40 lb) upon arrival at the feedlot.

2. Mean rectal temperature upon arrival at the feedlot was normal (102°F) and similar to the arrival auction-barn temperature. Temperatures increased 2% (to 104°F) by feedlot day 4 and decreased to normal before feedlot day 28. These temperature changes (generally associated with shipping fever) indicate that the major feedlot respiratory disease problems occur during the first 2 weeks post arrival.

3. Rumen function decreases during market-transit were severe. Rumen gas producing potential (used as a measure of bacterial activity) and rumen protozoa concentration (count/ml of rumen fluid) decreased 80 to 85% and rumen liquid volume decreased 30%. None of these parameters had returned to pre-transit levels at feedlot day 28. Rumen pH increased slightly during market-transit and decreased to normal (6.5 to 6.8) values at the feedlot.

4. Serum potassium (potassium changes are associated with dehydration and recovery of cellular water) decreased 6.3% during the 24 hours in the auction-barn without feed and water, and this decrease was 14.2% when the calves arrived at the feedlot. Serum potassium continued to decrease during the first 4 days in the feedlot, and the return to pre-stress level was not complete by feedlot day 28.

Table 1. Weight and physiological changes[1] of feeder calves during market and transit stress and during feedlot adaptation

Parameter	Parameter values as a percent of that value upon arrival at the auction-barn						
	Market-transit			Feedlot day			
	Arrival at orderbuyer-barn (after 24 hr in auction-barn)	Departure orderbuyer-barn (after 3 day)	Arrival feed-lot (after 18 hr trucking)	4	11	28	144
	----------	----------	----------	%	----------	----------	----------
Body weight	93.8	97.7	92.5	96.0		101.4	157.4
Rectal temperature	---	100.0	100.0	102.0	101.0	100.0	100.0
Rumen functions							
Total volatile fatty acids	---	---	108.9	142.2	113.6	134.1	106.3
Acetate/proponate ratio	---	---	99.1	97.0	94.3	90.7	97.9
Rumen pH	---	104.4	101.6	94.9	98.7	95.2	
Rumen liquid volume	---	---	70.5	82.7	81.0	85.3	94.5
Rumen gas production potential	---	36.1	19.2	72.7	61.1	85.4	125.0
Protozoa concentration	---	---	15.7	69.1	72.8	65.7	122.5
Blood serum parameters							
Sodium	105.6	---	122.4	85.0	---	84.7	---
Potassium	91.7	---	85.8	84.0	---	95.2	---

[1]Table values are percentages of the respective parameters upon arrival at the auction-barn.

EFFECT OF FETUS CARRIED BY A BEEF COW ON GAIN AND CONDITION OF CURRENT CALF

D. A. Shannon and R. R. Shrode

Several researchers studying milk production of dairy cows have reported evidence of an effect of sire of fetus carried by a lactating cow on her milk production.

Considering traits of nursing beef calves as a reflection of the milk production of their dams, data on average daily gain and condition score of 5,618 calves in the Angus herd at the Plateau Experiment Station (PES) and the Polled Hereford herd at the Tobacco Experiment Station (TES) were used to test various effects of fetus carried by the cow on these traits of calf currently nursed by the cow. Data on the two traits were recorded at three average ages of calf, approximately 120 days, approximately 230 days (weaning) and approximately 365 days. The data were appropriately adjusted for known effects prior to analysis of variance to test fetal effects, including sire of fetus, sex of fetus and age of fetus at the time data were recorded from the nursing calf.

1. There was a significant effect of sire of fetus carried by the cow on both average daily gain and condition score of currently nursed calf at all three data collection times in the TES data, and the PES results were similar except that the effect on average daily gain at weaning and at a year of age was not significant.

2. The effect of sex of fetus was not significant in general; but after adjustment to remove variation in gain and condition score attributable to differences in birth weight of calf, sex of fetus had a significant effect on condition score at all three ages in the PES data and on average daily gain at 120 days in the TES data.

3. In the TES data collected at 120 days and at weaning there was a significant regression of the nursing calf traits on age of fetus at time of data collection, while in the PES data this regression was significant in the case of all nursing calf traits except condition score at 120 days and average daily gain at weaning.

A COMPARISON OF DIFFERENT REGIMENS OF FEEDING HOLSTEIN HEIFERS DURING GESTATION

E. W. Swanson, B. J. Bearden, C. R. Holmes, and D. O. Richardson

It has been generally advocated that Holstein heifers should weigh over 1200 pounds when they are two years old and ready to calve for the first time. Little information is available on the effects of different feeding regimens prior to achieving such size. If heifers gain very repidly in early months it is necessary to reduce their feeding level and rate of gain in later months to avoid fattening. Fattening of growing dairy heifers has been shown to reduce their lactating ability. It has also been postulated that a rapid rate of gain in late gestation may stimulate the level of initial lactation.

Experiments are in progress at MTES and Knoxville to compare four growth-rate treatments during the first gestation of normal Holstein heifers. The treatments are:

I. Fed to gain "normally" at 1.55 lb/day (controls).

II. Same as I to 29 wks gestation, then to gain 2 lb/day.

III. Restricted to gain 1.2 lb/day for 27 wk. then to gain 2 lb/day.

IV. Fed to gain 2 lb/day for 29 wk, then reduced to gain 1.2 lb/day.

Groups II and III were both fed extra grain in the 12 weeks before calving, which might stimulate lactation. Group IV was restricted in late lactation to avoid fattening.

Data from 208 heifers which have completed lactations on the experiment are presented in Table 1. All heifers were fed virtually ad libitum on complete mixed diets containing about 50% concentrate in dry matter, with corn silage and hay for roughage, during lactation.

Results in Table 1 are preliminary, because the groups have not been balanced for origin, heifer age, heifer size, length of gestation and other factors which may influence lactation.

There is a non-significant indication that heavier feeding in late gestation (group II) slightly increased calf size and lactation yield. This effect was not evident when increased gains in late gestation followed restricted gains (group III) in early gestation.

All four gestation feeding regimens resulted in heifers over 1200 lb by first calving, and very similar milk yields. The results suggest that the pattern of weight gains during the first gestation which results in adequate size at parturition is not of major importance for the first lactation performance.

Table 1. Responses of Holstein heifers to four different regimens of feeding during gestation.

Item Compared	Growth Sequence During Gestation			
	I Constant normal growth	II Normal, to high last 12 wk	III Sub-normal, to high last 12 wk	IV Super-normal, to low last 12 wk
Heifers per group (No.)	63	54	47	44
Body weight at conception, lb ± S.E.	800.3 9.8	816.9 10.7	830.5 13.5	813.2 11.4
Daily gain to 27-29 wk lb ± S.E.	1.59 .02	1.65 .02	1.18 .03	2.06 .03
Body weight-12 wk prepartum lb ± S.E.	1104.0 11.0	1128.4 11.6	1068.1 12.6	1207.4 13.2
Daily gain, 12 wk prepartum lb ± S.E.	1.54 .06	2.49 .05	2.38 .07	1.03 .07
Body weight at calving lb ± S.E.	1233.5 12.5	1337.1 11.8	1268.2 14.3	1295.2 15.3
Age at calving mo ± S.E.	24.4 .2	24.8 .2	24.8 .2	24.4 .2
Gestation period days ± S.E.	275.4 .8	276.2 1.0	276.2 1.0	279.0 .7
Milk yield, 42 wk lb ± S.E.	14124 255	14622 270	14264 360	14462 366
Calf weights lb ± S.E.	81.9 1.6	86.4 1.6	84.0 1.7	84.6 1.6

A COMPARISON OF DRY TREATING AND A TEAT SEALANT AS MECHANISMS FOR REDUCING NEW MASTITIS INFECTIONS IN DAIRY COWS DURING THE DRY PERIOD

Martha Cunningham, D. O. Richardson and R. D. Walker

Research has demonstrated the effectiveness of dry cow therapy as a means of mastitis control. However, the possible use of a teat sealant or a combination of dry treatment and teat sealing as mechanisms of mastitis prevention during dry periods have not been reported.

Quarter samples were obtained and cultured from 71 cows at the University of Tennessee, Knoxville dairy herd. The cows were first grouped by breed and parity levels then randomly assigned to four treatment groups. Cows in Group I were an untreated control. Cows in Group II received the teat sealant and those in Group III received a commercial dry treatment. Group IV cows received both the sealant and the dry treatment. Since the sealant was not germicidal, an iodine dip was applied to all cows after dry treatment and/or before sealing.

Quarter samples were taken for culturing prior to the dry period and again within 10 days after freshening. The change in infection derived by the two samples was the primary response measurement.

1. Either treatment was somewhat better than the control; however, the dry cow treatment was the most effective treatment.

2. Although the sealant used in this study was not as effective as dry treatment, it should be mentioned that the sealant was not germicidal nor designed for prolonged use. In this study it was necessary to reseal the teats about every 14 days. It might be possible to develop an effective sealant that had the capabilities of being longer lasting and germicidal.

Table 1. Distribution of quarters infected with either S. aureus or streptococci into infection status groups

Treatment group	No. cows	No. qtrs.	Infection status groups (a) None	Cleared	New	Both
			(%)	(%)	(%)	(%)
Untreated	14	54	51.9	13.0	20.4	14.8
Sealed	19	76	61.8	14.5	11.8	11.8
Dry treated	20	78	82.1	11.5	2.6	3.9
Sealed and dry treated	18	72	61.1	23.6	7.0	8.3

(a) None was uninfected in both pre-and post-treatment cultures.
Cleared was infected in the pretreatment culture and uninfected in postculture.
New was uninfected in the pretreatment culture and infected in postculture.
Both was infected in both the pre-and post-treatment cultures.

Table 2. Change in number of infected quarters per cow

Treatment group	No. of infected qtrs per cow							Totals
	-3	-2	-1	0	1	2	3	
1	1	2	0	4	3	4	0	14
2	1	2	2	10	2	1	1	19
3	1	1	3	14	1	0	0	20
4	1	5	4	5	2	0	1	18
Totals	4	10	9	33	8	5	2	71

Table 3. Analysis of change in number of quarters per cow infected with either S. aureus or streptococci

Source	Df	Chi square	Probability of larger chi squares
Intercept	1	1.80	$\leq$0.18
Breed	1	0.02	$\leq$0.89
Parity	1	0.26	$\leq$0.61
Sealant	1	3.00	$\leq$0.08
Dry treatment	1	5.06	$\leq$0.02
Residual	11	6.94	$\leq$0.80

REFRACTORINESS OF BOTH UTERUS AND MAMMARY GLAND OF THE COW TO PROSTAGLANDIN $F_{2\alpha}$ ADMINISTRATION: CLINICAL IMPLICATION

H. Eiler, J. Oden, R. Schaub and M. Sims

In the therapy of metritis and mastitis, the evacuation of uterine or mammary gland (or both) contents is often used in conjunction with antibiotic treatment. In veterinary practice, oxytocin has been widely used for this purpose. The uterotonic and milk ejecting properties of $PGF_{2\alpha}$ have been documented. The clinical use of $PGF_{2\alpha}$ as a myotonic drug to evacuate either uterine or mammary gland contents seems possible. The objective in the present work was to evaluate the effect of increasing the dosage of $PGF_{2\alpha}$ on the contractile activity of both the uterus and the mammary gland in the lactating cow. In addition, the responsiveness to oxytocin of both organs (see dosage in Figure 1) was tested.

1. An indwelling jugular cannula was inserted into each cow for injection of drugs during the experiment. Uterine and mammary pressure changes were simultaneously measured in five lactating nonpregnant cows injected (IV) with different doses (0.1-32.0 mg) of prostaglandin $F_{2\alpha}$; the experiment was repeated 3 days later.

2. The total work of the uterus increased up to 250% of baseline value as the dose of $PGF_{2\alpha}$ was increased. But, no linear dose-response relationship was found in the uterus (Figure 1).

3. Partial refractoriness was developed in the uterus (Figures 1 and 2), and total refractoriness was developed in the mammary gland (Figure 3) to $PGF_{2\alpha}$ injection. Further challenge with oxytocin (30 U) elicited significant responses in both the uterus and the mammary gland (Figures 1, 2 and 3).

4. Because of the development of refractoriness and side effects, $PGF_{2\alpha}$ is not recommended as a drug to be used in the cow when evacuation (free of endocrine effect) of the uterus or mammary gland (or both) is indicated.

Figure 1

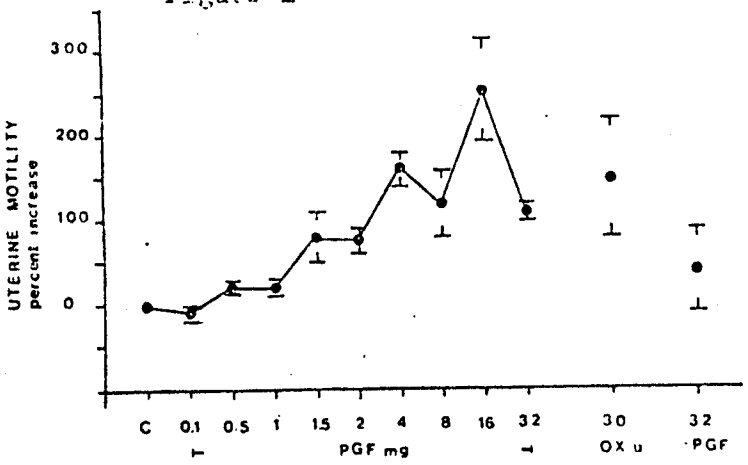

Figure 1.

Effect of increasing doses of $PGF_{2\alpha}$ and subsequent challenge with oxytocin (OX u) on uterine motility (mean ± SEM). C, baseline.

Figure 2

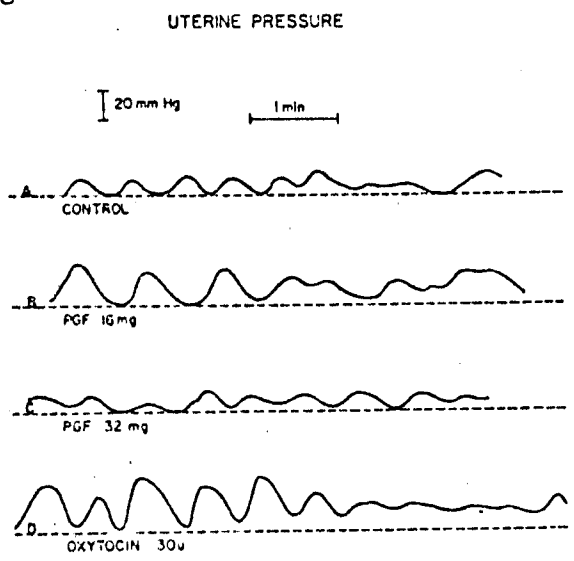

Figure 2.

Effect of repetitive administration of $PGF_{2\alpha}$ and subsequent challenge with oxytocin in cow number 1.

Figure 3

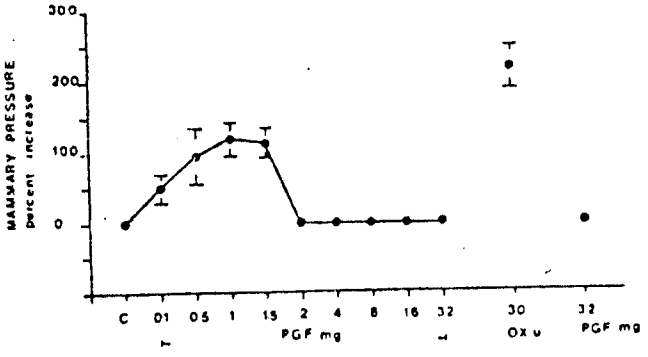

Figure 3.

Effect of increasing dosage of $PGF_{2\alpha}$ and subsequent challenge of oxytocin (OX u) on intramammary pressure. C, baseline (mean ± SEM).

EFFECT OF CORN SILAGE ADDITIVES ON COMPOSITION AND DIGESTIBILITY

K. T. Leahy, K. M. Barth, D. D. Howard and V. L. Fulgoni III

Proper fermentation of corn silage minimizes loss of nutrients and thus results in a good feed. There are many fermentation aid products available to farmers today that are said to decrease nutrient loss by improving the rate or type of silage fermentation. The effectiveness of many of these products is questionable and they need to be studied to determine their true worth.

Chopped whole corn plants (with or without additives) in the early dent stage containing approximately 25% dry matter were ensiled in 1.8 m x 9.1 m upright brick silos for 140 days. There were four experimental fermentation aid treatments with two silos per treatment. The fermentation aids added at time of ensiling were: control (no additive), Silabac (a live lactobacillus), Culbac (a dead lactobacillus) and Crop Cure (sodium diacetate). All additives were used at the rate of 0.05% on a wet basis, as suggested by the manufacturers. Silage samples were analysed chemically to determine the nutrient composition of each of the fermentation aid treatments. A conventional digestion trial was conducted with sixteen mature wether sheep averaging 74.5 kg in weight. Four sheep were allotted, by weight, to each of the four silage treatments. An 8-day preliminary period and a 7-day sample collection period were used. Ration consumption and apparent nutrient digestibility was also determined for each of the silage rations. Table 1 contains the nutrient composition of each of the four rations while table 2 contains ration intake and nutrient digestibility.

1. The fermentation aids had very little effect on nutrient composition of the silages.

2. The dry matter intake was significantly lower for animals fed rations with additives than for those fed the control ration.

3. Crude protein digestibility was significantly lower for Culbac and Crop Cure rations than for control and Silabac rations.

4. All fermentation additives increased ether extract digestibility while total digestible nutrients remained unchanged between treatments.

Table 1. Nutrient composition of rations, %

Variable	Corn silages			
	Control	Silabac	Culbac	Crop cure
Level of additive, %[a]	----	.05	.05	.05
Dry matter[a]	26.3	26.2	26.2	27.0
Crude protein[b]	8.3	7.9	8.1	8.0
Ether extract[b]	2.6	2.3	2.5	2.6
Crude fiber[b]	21.6	21.8	20.5	19.7
Ash[b]	5.4	4.8	4.4	4.2
N-free extract[b]	62.0	62.8	64.5	65.9
Acid-detergent fiber[b]	27.1	27.4	27.4	26.2

[a]Fresh basis.

[b]Dry-matter basis.

Table 2. Ration intake and apparent nutrient digestibility

Variable	Corn silage			
	Control	Silabac	Culbac	Crop cure
Number of wethers	4	4	4	4
Body weight, kg	74.4	73.7	73.6	76.3
Dry matter intake, kg/day	1.37[a]	1.17[b]	1.06[b]	1.20[b]
Apparent digestion coefficients, %				
Dry matter	68.1[a]	69.7[a]	67.7[a]	66.6[a]
Organic matter	67.1[a]	68.1[a]	68.5[a]	69.3[a]
Crude protein	56.8[a]	57.6[a]	54.3[b]	54.9[b]
Ether extract	75.7[a]	85.4[b]	82.4[c]	83.7[bc]
Crude fiber	57.6[a]	62.5[a]	55.9[a]	55.4[a]
N-free extract	75.2[a]	75.2[a]	75.0[a]	73.8[a]
Acid-detergent fiber	49.1[a]	47.3[a]	50.6[a]	47.6[a]
Total digestible nutrients, %	68.2[a]	69.8[a]	68.7[a]	68.5[a]

[a,b]Means on the same line with the same superscript are not significantly different ($P<.05$).

THE EFFECTS OF SILAGE ADDITIVES ON THE DIGESTIBILITY OF CAGED LAYER EXCRETA-CORN STOVER SILAGE

V. L. Fulgoni, III, K. M. Barth and K. T. Leahy

Large quantities of manure from laying hens (also called caged layer excreta-CLE) and corn stover, both agricultural byproducts, are available annually. CLE contains large quantities of nitrogenous compounds (24% crude protein) and minerals (38% ash) but relatively little fiber (11% crude fiber). The nitrogen is mainly uric acid which can be converted to protein by microbes present in the rumen of cattle and sheep. Corn stover, on the other hand, contains very little nitrogen (6% crude protein) but the fiber content is rather high (28% crude fiber). Therefore, it would be logical to combine CLE and corn stover in one diet. Virtual elimination of pathogens present in CLE is necessary before the material can be fed to animals. This can be accomplished by ensiling which is effective and inexpensive.

A preliminary digestion trial was conducted to determine the optimum proportions of CLE and corn stover to ensile. Either 18 or 30% CLE was combined with 50% corn stover and various quantities of water to achieve a 50% moisture silage. After a six-week ensiling period, both silages were consumed well by mature wether sheep. Recently, silage additives have been used to enhance fermentation and preservation. The objectives of this experiment were to study the effects of ensiling an intermediate level (22%) of CLE (as compared to the preliminary trial), corn stover and water with or without silage additives on nutrient digestibility by mature wether sheep. A digestion trial was conducted with 16 mature wethers, four sheep per treatment. The treatments were, 1) no additive (control); 2) Silabac (a bacterial preparation) added at .05%; 3) phosphoric acid (an acid) added at .4%; and 4) the conbination of 2 and 3. The CLE-corn stover mixtures, with or without additives, were ensiled in plastic lined 55-gallon drums for a period of 6 weeks. Composition of the rations are presented in Table 1 while intake and digestibility data are presented in Table 2.

1. The moisture content of the silages was between 54-62 percent. The silages contained approximately 9.5% crude protein, 30% crude fiber (41% ADF) and about 12% ash.

2. The dry matter intake was approximately 1 kg/day/sheep although the sheep fed additive treated silages tended to have decreased intake ($P<.10$). Dry matter, crude fiber and nitrogen-free extract digestibilities were increased ($P<.05$) when additive treated silages were fed. The total digestible nutrients were also greater for the additive treated silages ($P<.05$).

3. Phosphoric acid treated CLE-corn stover silage supported increased ($P<.05$) ether extract digestibility but sheep on this treatment had lower ($P<.05$) crude protein and acid-detergent fiber digestibility as compared to sheep fed the Silabac treated silage.

4. The combination of phosphoric acid and Silabac supported increased ($P<.01$) ether extract digestibility over either the addition of phosphoric acid or Silabac to the CLE-corn stover mixtures. However, total digestible nutrients were lower when the combination of additives was used as compared to the individual additives ($P<.05$).

Table 1. Nutrient composition of ration constituents and rations, %

Constituent or ration	Dry matter[b]	Crude protein[a]	Ether extract[a]	Crude fiber[a]	Ash[a]	Nitrogen free extract[a]	Acid detergent fiber[a]
Ration constituents							
Corn stover	89.0	6.1	0.71	28.0	7.3	57.9	43.4
Caged layer excreta	31.0	24.2	2.20	10.7	38.3	24.6	18.1
Caged layer excreta-corn stover silages							
No additive	58.4	9.2	1.22	27.9	12.5	49.1	42.5
Plus Silabac	53.5	8.6	0.96	28.0	11.4	51.1	42.4
Plus phosphoric acid	55.2	8.4	0.85	30.4	9.4	51.0	45.0
Plus Silabac and phosphoric acid	61.6	10.1	1.20	28.2	15.2	44.8	40.9

[a]Dry-matter basis.

[b]Fresh basis.

Table 2. Ration intake and apparent nutrient digestibility

Variable	Caged layer excreta - corn stover silages			
	Control	+Silabac	+Phosphoric acid	+Phosphoric acid +Silabac
Number of wethers	4	4	4	4
Body weight, kg	77.2	75.1	73.9	74.7
N in ration, %[a]	1.48	1.37	1.34	1.62
Dry matter intake, kg/day	1.22	.97	.98	1.14
Apparent digestion coefficients, %				
Dry matter	36.9	40.8	39.6	42.2
Organic matter	40.7	42.8	45.0	44.2
Crude protein	47.5	40.5	31.3	45.9
Ether extract	66.0	58.8	66.0	75.6
Crude fiber	39.5	44.1	47.6	43.4
N-free extract	41.8	46.4	45.4	43.5
Acid-detergent fiber	33.3	31.1	37.1	36.2
Total digestible nutrients, %	37.7	40.8	41.8	38.5

[a]Dry-matter basis

DEVELOPMENT OF HYPOMAGNESEMIA IN SHEEP CHANGED ABRUPTLY TO LOW MAGNESIUM-HIGH POTASSIUM DIETS

J. K. Miller, N. Ramsey, P. K. White, S. A. Khan[1] and M. D. Schneider

Cows may become severely hypomagnesemic in less than a week after an abrupt dietary change from stored feed to early spring pasture. This has been attributed to reduced Mg intake, lowered Mg availability due to high K content of forage or a combination of these factors. Effects of low Mg and high K intakes, singly or combined, on rapidity of development of hypomagnesemia in lambs are reported here.

Twelve wether lambs were fed a semi-purified diet containing .2% Mg and .8% K during a 34 day preliminary period. They were then divided randomly into four trios, one of which (group 2) was continued on the preliminary diet. Diets fed the other groups contained .01% Mg and .8% K (group 1), .01% Mg and 4% K (group 3) or .2% Mg and 4% K (group 4). Urine was collected and sampled daily; blood was sampled at 2-5 day intervals for Mg analysis.

1. With the abrupt diet change, average Mg intake of lambs in groups 1 and 3 dropped from over 1 g to less than 70 mg per day; K intakes of lambs in groups 3 and 4 increased from 6 g to over 27 g per day.

2. Urinary excretion is considered to be the primary homeostatic regulator of plasma Mg and sharply reduced urinary Mg loss is one of the most reliable indicators of Mg deficiency. Within 24 hours after diet changes, decreases in urinary excretion of Mg averaged 60% for group 1 and 66% for group 3. Urinary Mg loss by lambs fed low-Mg diets was relatively negligible thereafter.

3. Plasma Mg concentrations remained constant for lambs in group 2 as expected but declined steadily for groups 1 and 3 after the change to low Mg diets. Addition of excess K to the diet of group 3 increased the rate of decline over that due to low Mg alone. During 15 days after the diet change, decreases in mg of Mg/100 ml of plasma averaged 1.27 for group 1, 1.77 for group 3 and .26 for group 4.

4. The very low Mg content of diets 1 and 3 reduced available Mg to levels below that expected as a result of the combined reductions in Mg intake and absorption when ruminants graze early spring pasture. Since dietary Mg content was so low, a reduction in absorption of Mg would have little additional effect on that available. Thus, the added hypomagnesemic effect of excess K in diet 3 must have been due to a mechanism other than reduced absorption. Results of previous experiments suggest that transfer of Mg to extravascular spaces could contribute to reduced plasma Mg when dietary K is excessive.

[1]International Atomic Energy Agency Fellow

Table 1. Blood plasma urine magnesium contents of sheep changed abruptly to low magnesium-high potassium diets.

Measurement and day after diet change	Diet							
	Low Mg-normal K		Normal Mg-normal K		Low Mg-high K		Normal Mg-high K	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Plasma Mg (mg/100 ml)								
-34	2.25	.04	2.28	.04	2.18	.04	2.21	.02
-20	2.32	.03	2.49	.20	2.46	.12	2.34	.10
-6	2.47	.07	2.21	.03	2.18	.04	2.30	.06
2	1.76	.07	2.55	.07	1.32	.04	2.22	.08
4	1.25	.16	2.27	.05	.87	.06	1.97	.05
8	1.15	.13	2.37	.06	.67	.07	2.03	.05
10	1.11	.17	2.57	.02	.68	.06	2.13	.09
15	1.08	.23	2.38	.10	.50	.06	2.02	.04
Urine Mg (mg/day)								
-25	360	50	411	47	467	33	377	42
-24	431	30	369	49	455	33	338	57
-23	457	6	362	77	363	33	343	64
-22	563	23	337	50	215	51	260	35
-21	467	20	260	81	450	88	389	73
0	282	99	268	86	177	81	332	46
1	112	54	391	27	61	8	224	50
2	22	16	615	231	38	2	190	8
3	23	7	403	38	30	3	250	70
7	11	6	472	19	19	4	429	102
10	12	7	566	44	20	5	287	25

BLOOD PLATELET FUNCTION IN HYPOMAGNESEMIC SHEEP[1]

J. K. Miller, M. D. Schneider, N. Ramsey, P. K. White and F. R. Mraz

The similarity between lesions in cows dying of hypomagnesemic tetany and those induced in laboratory animals by clumping of platelets prompted an investigation of *in vitro* hemostatic ability of platelets from hypomagnesemic sheep.

Four groups of six lambs each were fed semipurified diets containing .01% Mg and .22% K (group 1) supplemented with .2% Mg (group 2), 3.6% K (group 3) or both Mg and K (group 4). Blood samples were obtained after animals in groups 1 and 3 had become severely hypomagnesemic. Progressive dilutions of a platelet active collagen preparation, ADP and thrombin were used to determine threshold levels of these agonists which would cause irreversible aggregation of platelets.

1. Changes observed after three months in lambs fed the two Mg-deficient diets included decreased Mg and Ca concentrations in plasma and packed cells and increased leukocyte and platelet numbers (Table 1).

2. Although groups 1 and 3 were severely hypomagnesemic, no consistent treatment effects on platelet reactivity to collagen were found. Response of platelets to the lower concentrations of thrombin and ADP was reduced in Mg-deficient lambs, however, as evident from prolonged delay of aggregation after addition of thrombin and reduced velocity and intensity of aggregation after addition of ADP.

3. One lamb fed diet 3, which became excited by being moved to another pen, suffered an attack and died suddenly. Lungs were highly congested, edematous and flesh-like in appearance with the apical lobe hemmorrhagic. Petechial and ecchymotic hemmorrhages were observed on the epicardial surface of both ventricle walls and the cut surface of the left ventricle wall showed a large, fresh, hemorrhagic infarct.

4. Another lamb fed diet 3 was found lying on its side in tremors with its head drawn back. Although gross anatomic lesions were less severe than in the previous lamb, platelet numbers in platelet rich plasma were only 10% of that in whole blood. Adherence of hyperactive platelets to erythrocytes is a possible explanation for this low recovery.

5. Lower *in vitro* reactivity of platelets from hypomagnesemic lambs to ADP and thrombin suggests that either a) lung changes found in hypomagnesemic lambs may have been caused by impaired hemostatic ability of platelets, or b) hyperactive platelets may have undergone a release reaction *in vivo* thus reducing reactivity of platelets available for *in vitro* testing.

[1] Supported by U.S. Department of Energy Contract No. DE-AC05-760R00242 and U.S. Department of Agriculture Grant No. 901-15-168.

Table 1. Cell number, mineral content and *in vitro* function of platelets from blood of lambs fed different levels of magnesium and potassium

Measurement, agonist and concentration	Group 1 Mean	1 SE	2 Mean	2 SE	3 Mean	3 SE	4 Mean	4 SE
Blood minerals (mEq/l)								
Magnesium								
Packed cells	1.35	.21	2.65	.61	1.19	.08	2.45	.35
Plasma	.56	.20	2.27	.19	.40	.13	2.10	.08
Calcium								
Packed cells	.40	.06	.58	.12	.45	.04	.53	.06
Plasma	4.69	.18	5.28	.13	4.86	.20	5.26	.12
Blood cell numbers								
Erythrocytes								
(x 10^6/ul)	10.94	.45	10.26	1.62	11.05	.46	10.11	.19
Leukocytes								
(x 10^3/ul)	9.92	1.77	3.65	.42	8.72	1.67	4.75	.61
Platelets								
(x 10^3/ul)	1168	295	764	100	1034	110	960	151
Platelet aggregation delay times (sec)								
Thrombin								
.5 units	81	11	64	9	106	23	55	4
1 unit	36	3	28	4	40	5	29	3
Collagen								
.156 ug	137	70	190	96	139	71	178	78
1.25 ug	33	8	26	3	49	12	30	5
10 ug	23	6	24	4	27	6	36	8
100 ug	18	3	17	2	17	2	33	13
Velocity of aggregation (%/min)								
ADP								
.5 uM	27	3	29	8	15	4	33	6
5 uM	74	11	70	4	70	4	89	7
Collagen								
.156 ug	17	5	14	10	11	3	16	11
1.25 ug	59	8	62	4	60	5	75	4
10 ug	79	7	77	4	77	5	86	6
100 ug	66	4	67	10	72	5	65	6
Intensity of aggregation (%)								
ADP								
.5 uM	26	5	46	21	12	3	49	16
5 uM	85	4	85	6	86	3	91	4
Collagen								
.156 ug	43	10	33	22	33	8	30	13
1.25 ug	86	6	86	5	94	2	95	2
10 ug	91	3	94	4	94	2	96	2
100 ug	89	4	91	4	96	1	99	1

CALCIUM METABOLISM IN HYPOMAGNESEMIC SHEEP

S. A. Khan[1], J. K. Miller, M. D. Schneider, P. K. White
N. Ramsey and F. R. Mraz

Hypomagnesemia in cattle or sheep grazing early spring pasture or fed Mg-deficient diets is often accompanied by hypocalcemia. Blood Ca of such animals usually will not respond to dietary Ca alone but can be raised toward normal by supplemental Mg. Total- and radio-Ca metabolism of normal, hypomagnesemic, hyperkalemic and hypomagnesemic-hyperkalemic sheep were compared to investigate possible causes of hypocalcemia in Mg-deficient ruminants.

Thirty-six weaned lambs were divided equally into four groups of nine lambs each which were fed diets deficient (.01%) or adequate (.2%) in Mg and adequate (.8%) or excessive (4%) in K in a factorial arrangement of treatments. Three lambs on each diet were simultaneously dosed orally with ^{45}Ca and intravenously with ^{47}Ca after 2 weeks on treatment. Dosing was followed by frequent sampling of blood, urine and feces for total and radiocalcium measurement. Nutritional balances of Mg and Ca were measured for six lambs fed each diet after 2 months on treatment.

1. Lambs fed the two Mg-deficient diets became severely hypomagnesemic within 2 weeks as indicated by low plasma and urinary Mg concentrations (Table 1). Lambs fed the low Mg-high K diet became deficient sooner and to a greater degree than lambs fed the diet low in Mg but not excessive in K. Plasma Ca concentrations were 8 to 11% lower in hypomagnesemic than in normomagnesemic lambs after 2 months.

2. Lambs fed low Mg diets consumed only 38 mg of Mg per day but excreted over twice that amount in feces resulting in negative balance despite very low urinary losses of Mg.

3. Apparent absorption and balance of Ca were not reduced by Mg deficiency. In fact, apparent absorption of orally administered ^{45}Ca was higher in Mg-deficient than in Mg-adequate lambs. This difference appeared to result more from increased absorption rather than from lower endogenous loss of Ca in feces of Mg-deficient lambs.

4. Urinary excretion of radio-Ca was higher by sheep fed the higher dietary K levels but urine is a minor route of excretion for Ca.

5. Lower plasma Ca in Mg-deficient sheep could not be explained by reduced absorption or increased excretion of Ca.

[1]International Atomic Energy Agency Fellow.

Table 1. Metabolism of magnesium and calcium by lambs fed diets adequate or deficient in magnesium and low or high in potassium

Measurement and time on treatment	Diet							
	Low Mg-normal K		Normal Mg-normal K		Low Mg-high K		Normal Mg-high K	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Plasma Mg (mg/100 ml)								
2 weeks	1.03	.19	2.42	.07	.48	.06	2.01	.04
2 months	.68	.24	2.76	.23	.49	.16	2.55	.10
Plasma Ca (mg/100 ml)								
2 weeks	8.90	.16	9.48	.15	8.53	.32	9.06	.20
2 months	9.40	.36	10.58	.26	9.73	.40	10.54	.24
Urinary Mg (mg/day)								
2 weeks	11	6	498	44	20	5	358	25
2 months	19	4	188	1	6	2	164	28
Ca balance (mg/day)								
Intake	1602	329	1991	34	1450	239	1953	176
Feces	1373	31	2108	198	1032	127	1655	162
Urine	20	7	23	17	19	1	20	9
Balance	209	352	-140	212	399	112	278	23
Radio-Ca (% of dose)								
Apparent absorption	47.3	10.0	29.4	1.0	43.8	9.1	28.0	1.3
True absorption	53.3	10.2	33.3	1.1	48.8	9.5	32.3	1.4
Endogenous fecal Ca	6.0	.9	3.9	.2	5.0	.5	4.3	.4
Oral ^{45}Ca								
Feces	52.7	10.0	76.6	1.0	56.2	9.1	72.0	1.3
Urine	.06	.01	.09	.02	.24	.02	.28	.03
Intravenous ^{47}Ca								
Feces	11.8	2.0	11.6	.3	10.9	1.4	13.2	1.1
Urine	.31	.23	1.25	.29	1.17	.10	3.29	1.62

LIFE SPAN AND TISSUE DISTRIBUTION OF ^{111}INDIUM-LABELED BLOOD PLATELETS IN HYPOMAGNESEMIC LAMBS[1]

M. D. Schneider, J. K. Miller, P. K. White and N. Ramsey

Blood platelets may adhere to exposed elements such as collagen in vascular lesions which develop on magnesium deficient ruminants. This could initiate platelet aggregation and release reactions which if uncontrolled might lead to thrombosis, lung spasm and sudden death. Rate of disappearance from circulation and deposition of platelets in tissues of normal and hypomagnesemic lambs are compared in this report.

As part of a larger study, two groups of 18 lambs each were fed semipurified diets containing .01% or .2% Mg for at least 3 months. Five hypomagnesemic and three control lambs were injected intravenously with autologous blood platelets labeled *in vitro* with indium-111. Blood was sampled periodically and after 68 hours they were injected intravenously with a platelet active fibrillar collagen preparation at the rate of 500 ug/kg body weight. Blood was sampled during 30 minutes before lambs were terminated for necropsy.

1. During 68 hours after intravenous injection, ^{111}In concentrations were 11 times higher in packed cells than in plasma (Table 1). Indium-111 in packed cells, which presumably included labeled platelets, increased over 60% during 2 hours after injection. This most likely resulted from initial tissue sequestration and subsequent release of labeled platelets.

2. Platelet life spans, calculated from the regression of the natural logarithm of packed cells ^{111}In from 2 to 68 hours after injection, averaged 60 and 63 hours for hypomagnesemic and control lambs. Within 1 minute after injection with the platelet active collagen preparation, 83% of the ^{111}In in packed cells disappeared from circulation (Table 2).

3. Four of 18 hypomagnesemic lambs developed tetany and died. Necropsy revealed changes compatible with right heart failure complicated by pulmonary edema. Similar changes were found in three hypomagnesemic and two normomagnesemic lambs 30 minutes after injection with collagen. These changes were prevented by heat inactivation of the collagen before injection.

4. Lung, liver and spleen contained the greatest amounts of ^{111}In 68 hours after intravenous injection with labeled platelets (Table 2). Organ content of ^{111}In was not affected by Mg intake. Lung deposition of ^{111}In appeared to be somewhat lower in lambs injected with heat inactivated collagen.

5. Similarity of lesions induced by reversible *in vivo* platelet aggregation to those in lambs which died spontaneously suggest that contact between blood platelets and exposed subendothelial damage could be a significant mortality risk factor in hypomagnesemic tetany. Platelet life span or sensitivity to collagen were similar for hypomagnesemic and control lambs; however, the triggering mechanism of sudden death in hypomagnesemic ruminants remains to be identified.

[1]Supported by U.S. Department of Energy Contract No. DE-AC05-760R00242 and U.S. Department of Agriculture Grant No. 901-15-168.

Table 1. Indium-111 concentrations in packed blood cells and platelet life span in magnesium deficient and adequate lambs injected with autologous ^{111}In-labeled platelets

Time after injection	Magnesium deficient		Magnesium adequate	
	Packed cells	Plasma	Packed cells	Plasma
	(% of dose/liter)			
5 min	31.9	3.6	33.0	3.2
10 min	36.8	3.9	36.9	3.7
15 min	39.8	4.2	39.4	3.8
30 min	45.7	4.8	46.6	3.9
1 hr	48.3	4.5	45.5	4.2
2 hr	51.9	5.0	44.9	4.2
19 hr	45.2	3.0	36.8	3.8
24 hr	42.1	3.5	38.2	2.9
42 hr	33.4	2.7	30.7	1.9
48 hr	30.6	3.0	27.1	1.9
68 hr	26.3	2.0	19.2	1.5

Table 2. *In vivo* response of ^{111}In-labeled blood platelets to intravenous injection of platelet active fibrillar collagen into magnesium deficient and adequate lambs and subsequent content of ^{111}In in organs

Measurement	Magnesium deficient			Magnesium adequate	
	Active collagen	Heat inactivated collagen	Buffer only	Active collagen	Heat inactivated collagen
	(% of pre-collagen injection)				
Packed cell ^{111}In					
Time after injection					
-1 min	100	100	100	100	100
+1 min	16.9	94.0	98.3	17.0	97.9
+5 min	44.8	93.0	98.7	45.1	------
+15 min	59.7	101.9	92.2	50.4	101.0
+30 min	59.4	82.8	94.7	54.5	97.4
	(% of dose)				
Organ ^{111}In					
Organ					
Lungs	26.60	13.11	33.41	20.41	13.32
Liver	16.24	22.57	29.18	21.33	20.57
Spleen	9.53	12.97	15.51	8.96	17.16
Kidney	.53	.77	1.07	.55	.44
Heart	.22	.20	.33	.14	.18
Brain	.03	.02	.05	.02	.02

USE OF "EXOTOC BREEDS" OF SHEEP TO INCREASE LAMB PRODUCTION IN TENNESSEE

E. R. Lidvall and F. B. Masincupp

The number of lambs born and reared per ewe per year is most important to sheep producer profits. There are a number of breeds known for high lambing rates which have been imported into the United States and Canada in recent years. Three of the breeds were selected for their apparent desirable reproductive capabilities (multiple lambing rate and/or 'out-of-season' breeding). Two rams of each breed were crossed on the parent ewe flock (Knoxville Station) of predominantly Hampshire breeding during 1976 and 1977 to produce F_1 crosses. The breeds utilized were:

Finnish Landrace: The Finnsheep breed was developed in Finnland and has been bred for scores of generations with no intermixture of other blood. They are rather average in size, flat muscled, free of wool on the face and legs, and low yielding in regards to wool production. They are very prolific, averaging about 1.8 lambs for a yearling ewe and 2.65 lambs for an adult ewe.

Clun Forest: The Clun Forest is a European breed which has found favor in England and Wales. Only a few have been imported to the United States. They are a relatively large breed, have a typical mutton or meat conformation, are adequate in wool production and quality, and maintain a lambing rate well above 150%.

Barbados Blackbelly: The Blackbelly or "Barbs" were first recorded as imports from the West Indies to Texas in 1904. They tend to be dark in color, small in size and produce hair instead of wool. Their social structure and behavior varies considerably from the more conventional breeds. California observations report a lambing rate close to 3 lambs per ewe per year. They grow rather slowly and reach puberty at an early age.

All F_1 ewes have been bred to Suffolk rams. Lambs have been weaned at about 50 days of age and reared to a market weight of about 100 lbs. on slatted floors. Ewes have an opportunity to lamb three times in two years - January, September and May (8-month intervals). The ewes were first lambed at 16 months of age. Table 1 presents a summary of the ewe and lamb performance data to date.

1. The Finn ewes have proven to be the most prolific, averaging in excess of a 200% lamb crop born and 187% weaned and marketed each year.

2. Growth rate has been slightly superior in lambs from the Clun crossed ewes.

3. The Barbados ewes appear to have a slight advantage in lambing 'out-of-season' (September lambing). The Clun ewes seldom breed 'out-of-season'.

4. All crosses appear to produce desirable carcasses.

Table 1. Ewe and lamb performance data[1]

	F_1 ewes		
	Finnish Landrace	Clun Forest	Barbados Blackbelly
Ewes beginning project ('77-'78)	14	19	19
Ewes lost to date	4	2	2
Ewes per flock, 3-6-80	10	17	17
Av no ewes/flock to date	12	18	18
Av ewe wt 1-4-80, lbs	157	177	135
Av fleece wt (2-yr av), lbs	3.75	3.90	3.22
Ewe lambings/yr	15.2	22.0	24.4
% ewe lambings/yr	127	122	135
Lambs born to date[2]	65	68	80
Lambs born/flock/yr	26.0	27.2	32.0
% lamb crop born/flock/yr	217	151	178
Lambs weaned to date	56	62	77
Lambs weaned/flock/yr	22.4	24.8	30.8
% lamb crop weaned/flock/yr	187	138	171
Lambs raised to date	56	59	75
Lambs raised/flock/yr	22.4	23.6	30.0
% lamb crop raised/flock/yr	187	131	167
Av lamb birth wt, lbs	8.56	10.18	9.44
Av lamb wean (50 Da) wt, lbs	42.6	44.6	44.7
ADG, birth-weaning, lb	.685	.723	.682
Lbs lamb weaned/ewe in flock	79.5	61.5	76.5
ADG, wean-mk, lb[3]	.402	.406	.367
Carcass Traits[4]:			
No of lambs	8	7	19
Av wt of lambs, lbs[5]	98	91	92
Fat thickness, inch[5]	.17	.18	.17
Leg score[5]	13.2	13.1	12.6

[1]These data not corrected for age of ewe and type of birth or rearing.

[2]All lambs are sired by Suffolk rams.

[3]Reared on slatted floors in confinement.

[4]January 1979 lambs used as examples of carcass desirability.

[5]Subjective estimates of live lambs.

INTERNAL VOMITING IN THE RUMINANT: EFFECT OF APOMORPHINE ON RUMEN pH IN SHEEP

H. Eiler, W. A. Lyke and R. Johnson

During vomiting, gastric and occasionally intestinal contents are forcefully expelled through the mouth of the monogastric species. Ruminant vomiting is clinically recognized as expulsion of fluid from the mouth; the origin of vomitus in the ruminant is not known. Because of the multicompartmental anatomy of the ruminant stomach, there is the possibility that "internal vomiting" occurs. If this is true, it implies that vomiting in ruminants may not always be clinically observed because the acidic abomasal contents are not expelled through the mouth. Instead, the vomitus is expelled cranially into the pre-abomasal compartments, but remains within the stomach. This could change the pH of the ruminoreticularis content, thus endangering both the ruminal microflora and the integrity of the mucosa of the pre-abomasal compartment. The objective of this work was to determine whether apomorphine causes vomiting in the ruminant and to study the effect of the vomitus on ruminal pH. Five sheep, with rumen fistulas inserted, were each injected (iv) with apomorphine (18 mg) and ruminal pH was measured every 5 minutes during a 1-hour period.

1. During the base-line period (30 minutes) that preceeded apomorphine injection, pH was constant in individual sheep and the group mean ($\pm$ SD) was 7.1 $\pm$ 0.35.

2. After apomorphine was injected, group mean was 6.9, 6.0, 6.3, 6.3, 6.3, 6.4, 6.4, 6.5, 6.7, 6.9, 6.9, and 7.1 at 5, 10, 15, 20, 25, 30 35, 40, 45, 50, 55, and 60 minutes, respectively. The pH reduction of ruminal content was recorded in 4 of the sheep. Maximal reduction occurred in the 10-minute period after apomorphine was injected. The pH returned to control value within 40 to 50 minutes after injection (Figure 1).

3. No vomitus was expelled through the mouth by any of the sheep. It was concluded that expulsion of acidic abomasal contents back into the pre-abomasal compartment (internal vomiting) was the cause of acidification of the rumen after apomorphine was injected.

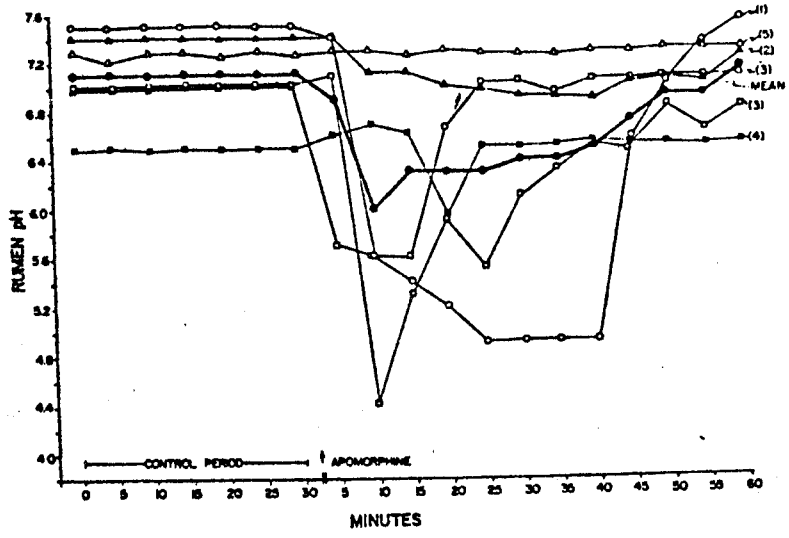

Figure 1. pH of rumen content before and after apomorphine (18 mg i.v.) injection as function of time in individual sheep (1-5). In parenthesis, number of individual sheep; sheep number 3 was studied twice - with a week between tests. Sheep number 5 did not respond to apomorphine injection. The dark tracing represents the mean value for 5 sheep.

A COMPARISON OF THREE FARROW-FINISH PORK PRODUCTION SYSTEMS AT AMES PLANTATION*

E. R. Lidvall, M. C. Dixon, R. L. Wyatt and J. M. Anderson

System I is a pasture system. Fifteen acres of orchard grass-ladino clover pasture are utilized for spring farrowing and finishing of the pigs during the summer. An additional eighteen acres is seeded to winter pasture for the production of fall farrowed pigs. Individual housing is utilized, pigs are farrowed in April and October, weaned at 8 weeks of age and one sow herd is maintained producing about 24 litters at each farrowing. System II is a modest investment system using a pen-type central farrowing house and finishing on pasture. Two sow herds are maintained; one herd farrowing in January and July and the other in April and October. Pigs are weaned at 8 weeks of age and moved to three-acre lots for growing and finishing. Sufficient sows and/or gilts are maintained to insure about 24 litters at each farrowing. System III uses a central environment control crate-type farrowing house, a pig nursery, and two partial slatted modified open front finishing barns. The farrowing house has 24 farrowing crates, pigs are weaned at 4-5 weeks of age, sows are immediately rebred, pigs are moved to the total slatted environment control nursery for approximately five weeks, and are then moved to one of the two finishing barns. Sufficient sows and/or gilts are maintained in four sow herds to insure 24 litters at each farrowing (9 farrowings per year). In all systems the sows are bred and gestated on pasture. The breeding program involves 3- and 4-way crosses utilizing Duroc, Hampshire, Landrace and Yorkshire boars. Rations are mixed in a portable type mixer using grain, soybean meal and a vitamin-mineral pre-mix.

1. Conception rate in System III was lower during 1979, due primarily to the addition of a number of gilts necessary to establish a fourth sow herd and some breeding problems.

2. Litters and pigs produced per sow per year are higher in System III because of earlier weaning and, therefore, the opportunity for more litters per year (2.3 vs 2.0 in Systems I and II).

3. Pigs farrowed per litter, pig birth weight, pigs weaned per litter, % pigs weaned of those born alive and days to 230 lbs. are similar for each system.

4. The pounds of feed required to produce a lb. of live pork from the farm favors System III because of greater production/sow/year and a more favorable feed efficiency during finishing. Feed required per lb. of gain from weaning to market has averaged about 4.0 lbs. in System I, 3.8 lbs. in System II and 3.5 lbs. in System III.

5. System II has produced the greatest net return per sow above all variable and fixed costs. Returns above only variable costs are not greatly different for each of the three systems.

*The University of Tennessee is the beneficiary of a perpetual trust under terms of the will of the late Julia C. Ames.

Table 1. Four-year average of sow, litter and pig performance of three swine production systems at Ames Plantation, years 1976-79

	System		
	I	II[1]	III
Sow herds maintained	1	2	3.2[2]
Number sows/system	29.7	61.1	96.6
Numbers litters produced/yr	48.5	100.5	175.0
Conception rate, %	81.5	82.3	78.5
Litters produced/sow/yr	1.64	1.65	1.84
Pigs produced/sow/yr	12.2	12.1	13.2
Pigs farrowed/litter	10.2	10.4	10.3
Pigs farrowed alive/litter	10.0	10.0	9.8
Pigs weaned/litter	7.4	7.4	7.3
% pigs weaned of born alive	73	73	74
Pig birth wt, lbs	3.2[3]	3.1[3]	3.1[4]
Pig wean wt, lbs	35.8	36.1	17.8
Final nursery wt, lbs	---	---	57.1
Average daily gain, nursery, lb	---	---	0.76
Market wt, lbs	231.4	228.0	216.2
Days to 230 lb market wt	204	207	208
Lbs of feed required to produce a pound of live pork[5]	4.25	4.09	4.00

[1]Some adjustment made in production figures for unusual 'predator losses' during finishing period.

[2]Three sow herds maintained during years 1976, 1977 and 1978. Four sow herds maintained during 1979.

[3]Pigs weaned at about 56 days of age.

[4]Pigs weaned at about 28-35 days of age.

[5]Includes breeding herd feed, creep feed, grower and finisher feed.

A COMPARISON OF DRY VS. LIQUID FEED FOR EARLY WEANED PIGS REARED IN CONFINEMENT

M. C. Dixon, R. L. Wyatt, D. D. Lampley, E. R. Lidvall and J. M. Anderson

A total of 1,234 Duroc-Hampshire-Landrace-Yorkshire crossbred pigs from eight farrowings were utilized in this study at Ames Plantation*. These pigs were farrowed and reared to an age of about four weeks and an average weight of 18.2 lbs in a crate-type environmentally controlled farrowing house. They had access to creep feed beginning at 10 days of age.

The environmentally controlled nursery consisted of 12 totally slatted pens measuring 8' x 8'. Six pens were equipped with cup-type waterers and tube (barrel) feeders. The remaining 6 pens were equipped with commercially available liquid feeders. Adjustments made it possible to vary the proportion of water and feed; however, a 'liquid ration' consisting of about two parts water to one part feed by weight was standard for the experiment. No additional water was offered to the pigs on liquid feed. The ration fed during the course of the experiment is presented in Table 1. Antibiotic source and level varied from time to time depending upon the general health of the pigs; however, all pens received similar treatment and levels of antibiotic in both feed and water. Pigs were assigned to experimental pens based primarily on weaning weight and breeding. Pigs remained in the nursery for about five weeks.

1. Death loss was similar and averaged about one percent in all groups.

2. Pigs fed dry feed gained .70 lb per day compared to .64 lb per day for liquid-fed pigs ($P<.05$). In only the November farrowed pigs did the liquid-fed pigs gain more rapidly than the dry-fed pigs.

3. All eight groups on liquid feed required less feed per lb of live weight gain than did the dry-fed pigs ($P<.001$).

4. There was a tendency for the pigs on liquid feed to get wet in the feeding process and, thus, to appear chilled even though the temperature was kept at a comfortable level in the nursery at all times.

5. The tube feeders were difficult to adjust and required constant attention in order to prevent feed wastage. Little, if any, feed was wasted by the pigs in the pens on liquid rations.

6. Pigs on liquid feed appeared more 'pot-bellied' as compared to the dry-fed pigs. Likely, they ingested more water than necessary in order to obtain a satisfactory portion of the ration.

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Table 1. Composition of 17.35% crude protein ration

Ingredient	Percentage of ration
Yellow corn	59.85
Soybean meal (44%)	25.00
Dried whey	10.00
Swine vitamin premix	5.00
Synthetic lysine	0.15
	100.00

Table 2. Means for average daily gain and feed efficiency of early weaned pigs fed dry and liquid rations in confinement

Date farrowed	No. of pigs on test[1]	ADG (lbs)		Feed/lb/gain	
		Dry	Liquid	Dry	Liquid[2]
June '79	99	0.87	0.83	2.60	2.14
August '79	89	0.78	0.72	2.84	2.42
September '79	156	0.71	0.67	2.94[a]	2.39[b]
October '79	220	0.58[a]	0.49[b]	2.75	2.54
November '79	121	0.69	0.71	3.01	2.38
January '80	101	0.78	0.77	2.72	2.19
February '80	223	0.66[a]	0.53[b]	2.77	2.60
March '80	225	0.79	0.73	2.87[a]	2.27[b]
Total pigs	1234				
Average performance, all groups		0.70[a]	0.64[b]	2.78[c]	2.36[d]

[1]One-half pigs fed dry feed; one-half pigs fed liquid feed.

[2]Liquid feed/lb gain calculated on dry feed basis.

[a,b]Means in the same row under a common heading with different superscripts are significantly different ($P<.05$).

[c,d]Means in the same row under a common heading with different superscripts are significantly different ($P<.001$).

EFFECTS OF ADRENOCORTICOTROPHIN ADMINISTRATION DURING EARLY GESTATION ON CONCEPTUS DEVELOPMENT IN SWINE

H. G. Kattesh, J. D. Arnold, T. T. Chen and R. L. Murphree

One of the major components used in the measurement of reproductive efficiency in swine is the number of pigs born alive, or litter size. Embryonic mortality in swine has been reported to account for a loss of 30 to 50 percent of potential offspring and numerous workers have established that under normal conditions most of this loss occurs prior to day 25 of gestation. In addition, it is known that stressful situations, occurring within the first two weeks of gestation, can further increase embryonic mortality in swine. However, at this point, the physiological and endocrinological events associated with stress-induced embryonic mortality are not well understood. The objective of this research was to determine if and when during early gestation adrenocorticotrophin administration adversely affects embryonic survival in swine.

Seventy-two six month old gilts of similar breeding were moved, mixed and relocated in equal numbers to one of six outdoor lots, each separated by a half-lot section containing three 10 month old boars. All gilts were observed through one normal estrous cycle by checking for estrus twice daily (morning and evening) with the aid of a boar. Upon detection of second estrus, gilts were artificiallyinseminated with approximately eight billion sperm cells at 12 and 24 hours after the onset for estrus using semen from a different boar each time. Each gilt was then randomly assigned in equal numbers to one of 12 treatment-period combinations until a total of 48 gilts had been obtained. The treatments consisted of a single daily intramuscular injection of either 0, 40 or 80 IU of an aqueous suspension of corticotropin with zinc hydroxide for repository action (Corticotropin Zinc, Organon Pharmaceuticals, West Orange, N.J.) over a period of five days. The periods of injection were either days 1-5, 6-10, 11-15 or 16-20 post-breeding. All 48 gilts were bred within a three week period.

1. Of the 48 gilts used in this study and bred by artificial insemination using diluted fresh semen, 42 gilts or 88 percent conceived. There were no significant differences among the 12 treatment-period combinations in conception rate.

2. Injections of adrenocorticotrophin, regardless of dosage or period given, had no significant effect on any of the maternal or conceptus parameters measured. The overall mean $\pm$ standard deviation for each parameter measured is given in Table 1.

Table 1. Overall values for various procine conceptus and maternal measurements taken at time of slaughter

Parameter	Mean ± standard deviation
Day of gestation	37.1 ± 1.2
Gilt slaughter weight, kg	123.0 ± 14.6
Number of corpora lutea	13.0 ± 2.0
Ovarian weight, g	13.9 ± 2.1
Number of live fetuses	9.7 ± 2.8
Number of dead fetuses	1.5 ± 1.3
Fetal survival, %	74.5 ± 1.6
Uterine surface area, cm^2	4578.0 ± 864.8
Uterine weight, g	1319.5 ± 302.0
Fetal crown-rump length, cm	4.7 ± .5
Fetal wet weight, g	8.8 ± 2.3
Placental length, cm	45.0 ± 7.2
Placental weight, g	66.2 ± 13.0
Allantoic fluid volume, ml	61.2 ± 26.8
Amniotic fluid volume, ml	10.1 ± 1.7
Combined adrenal weight, g	5.2 ± 1.1
Anterior vena cava, hematocrit, %	40.9 ± 2.4

COMBINED DEXAMETHASONE-SUPPRESSION COSYNTROPIN-(SYNTHETIC ACTH) STIMULATION TEST IN THE HORSE: A NEW APPROACH TO TESTING OF ADRENAL GLAND FUNCTION

H. Eiler, J. Oliver and D. Goble

Glucocorticoids are widely used in the horse for a variety of clinical conditions. Nontherapeutic use of glucocorticoids in the racehorse is viewed by trainers as a useful adjunct to conditioning. Corticotropin (ACTH) is also used for the same reasons. Glucocorticoid administration results in adrenal atrophy and deficiency of endogenous glucocorticoid secretion upon withdrawal.

The objective in the present study was to develop a combined dexamethasone-suppression cosyntropin-(synthetic ACTH) stimulation test (CDC test) in horses so that information concerning pituitary gland (hypophysis) and adrenal gland competence could be obtained in one relatively short test procedure.

1. The following test procedure was designed: (i) Collect base-line blood sample and then inject dexamethasone (10 mg, IM); begin testing procedure near 0900 hours. (ii) Collect second blood sample 3 hours later (to evaluate suppression of plasma hydrocortisone concentration), and then inject cosyntropin (1.0 mg or 100 IU, iv). (iii) Collect the third blood sample 2 hours later to evaluate stimulation of plasma hydrocortisone concentration.

2. The plasma hydrocortisone concentration (measured by competitive protein-binding (CPB)) decreased to 27% ($P<0.05$) of base-line values 3 hours after dexamethasone (20 mg, IM) was injected. Further suppression of hydrocortisone concentration did not occur at 5 hours. After cosyntropin was administered (1.0 mg or 100 IU, iv), maximal plasma hydrocortisone concentration (187% of base line) occurred at 2 hours, and the value at 4 hours approached base line (119% of base line). Mean plasma hydrocortisone concentration further declined to suppressed values (18% of base line) 19 hours after cosyntropin treatment, indicating that dexamethasone was still suppressing hydrocortisone release (Figure 1).

3. The plasma hydrocortisone concentrations, as measured by radioimmunoassay (RIA), were non-detectable (less than 10 ng/ml; compared with base line of 43.2 ± 9.3 ng/ml; mean $\pm$ SD) 3 hours after dexamethasone (10 mg, IM) was injected. After cosyntropin (synthetic ACTH) was administered (1.0 mg or 100 IU, iv), maximal plasma hydrocortisone concentrations (109 ± 18.2 mg/ml; 252% of base line) occurred at 2 hours (Table 1).

   When the CPB technique was used for quantitation of hydrocortisone, total suppression (below assay sensitivity) was never attained after dexamethasone injection. However, hydrocortisone values quantitated by CPB after cosyntropin was administered were approximately 200% above values obtained by the RIA technique (Table 1, Figure 2).

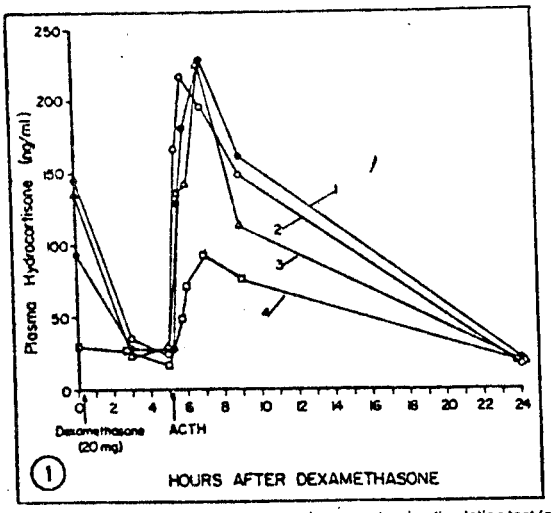

Fig 1—Effect of a combined dexamethasone-suppression cosyntropin-stimulation test (CDC test) on hydrocortisone (cortisol) concentration (determined by competitive protein-binding) of plasma in four mares (No. 1, 2, 3, and 4) of different ages (experiment 1). Significant suppression ($P < 0.05$) of plasma hydrocortisone occurred 3 hours after dexamethasone was given, while cosyntropin caused doubling of hydrocortisone values above base line.

TABLE 1—Combined Dexamethasone-Suppression Cosyntropin-Stimulation Test for Plasma Concentrations of Hydrocortisone in 15 Horses (Experiment 2)

Test procedure for plasma hydrocortisone concentration	Base-line (ng/ml)	Dexamethasone treatment: 3 Hours after injection (ng/ml)	Dexamethasone treatment: % Decrease from base line	Cosyntropin treatment: 2 Hours after injection (ng/ml)	Cosyntropin treatment: % Increase from base line
Radioimmunoassay					
Mean ± SD	43.3 ± 9.3	ND*	100	109.0 ± 18.2	252
(Min-max)	(29.5–66.6)	ND*	—	(79.9–136.9)	—
Competitive protein binding					
Mean ± SD	138.4 ± 30.9	48.0 ± 20.7	65	226.5 ± 20.5	164
(Min-max)	(99.8–221.9)	(20.5–86.1)	—	(198.9–250.9)	

* Nondetectable (less than 10 ng/ml, which is below the sensitivity of the assay).

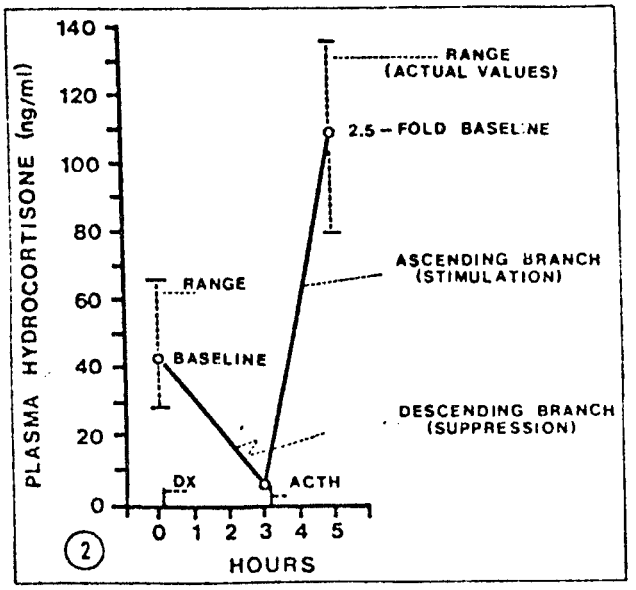

Fig 2—Diagrammatic representation of CDC test results (experiment 2). Sequential dexamethasone (DX) and cosyntropin (ACTH) administration resulted in a V-shaped curve, the right, ascending branch of the V represents the cosyntropin-stimulation phase, while the left descending branch of the V represents the dexamethasone-suppression phase, hence the test is referred to by the authors as the "V test."

INHIBITION OF GASTRIC HYDROCHLORIC ACID SECRETIONS BY OSTERTAGIA OSTERTAGI (A GASTRIC PARASITE OF CATTLE) EXTRACT IN THE RAT

H. Eiler, W. Baber, W. A. Lyke and R. Scholtens

Reduced hydrochloric acid secretion in the bovine abomasum, and elevation of pH to neutral or higher values is one result of Ostertagia ostertagi infections. This stomach parasite causes a sharp fall in hydrochloric acid secretion when the adult worms emerge from their developmental site in the gastric glands. It is postulated here that the adult O. ostertagi increases gastric pH by way of chemical (endocrine) mediators; the reduced acidity may favor arrival of the parasite in the gastric lumen after emergence into the stomach.

The purpose of this work was two-fold. First, to determine the effect of pH on the survival rate of the adult O. ostertagi. Second, to study the effect of the adult O. ostertagi (from the abomasum of calves) extract (injected IM) on hydrochloric acid secretion in the rat stomach. In addition, rabbit liver extract was used to test the effect of foreign proteins. Cimetidine, an inhibitor of HCl secretion, was injected to test the experimental model.

1. The immersion of freshly collected Ostertagia ostertagi adults into saline (NaCl 0.9 percent) pH 1.0 resulted in 100% mortality of worms within a 10-minute period. At pH 7.0, mortality was 58% after 270 minutes. At pH 2.2, which is at or very close to normal abomasal pH, 100% mortality resulted within 60 minutes.

2. Rats injected with O. ostertagi extract (from the abomasum of cattle) decreased total secretion of hydrogen ions and volumes of secretion ($P<0.05$) and caused the mean pH of gastric secretion to increase ($P< 0.05$). These effects were similar to that found in cimetidine treatment (Figures 1, 2 and 3).

3. Results suggest that the normal pH of the abomasum is detrimental to the parasites' survival, and hypochlorhydria found during ostertagiosis may be mediated partially by a chemical release from the parasite.

Figure 1

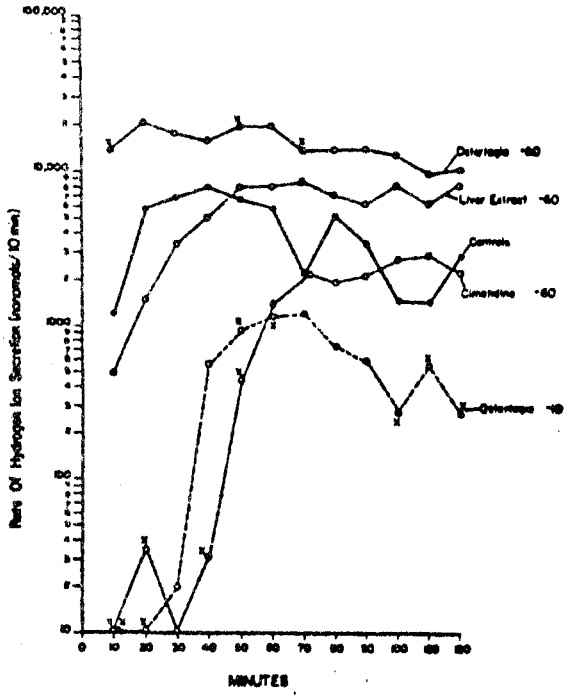

Figure 1. Hydrogen secretion as function of time in the rat stomach. (x) indicates significant ($P<0.05$) difference as compared to controls at the same period of time.

Figure 2

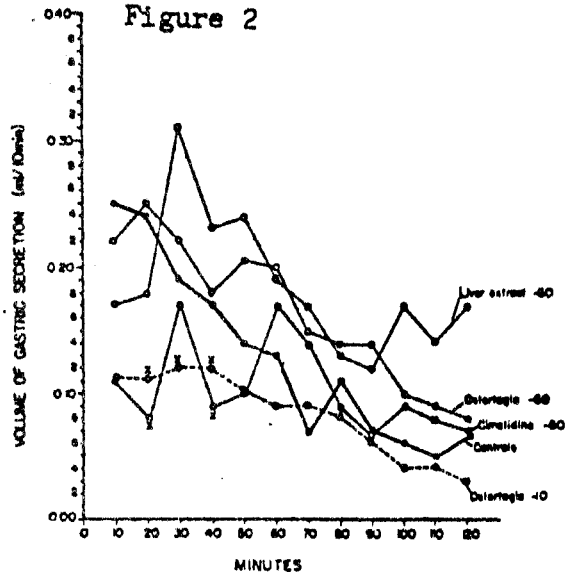

Figure 2. Volume of gastric secretion as function of time in the rat stomach

Figure 3

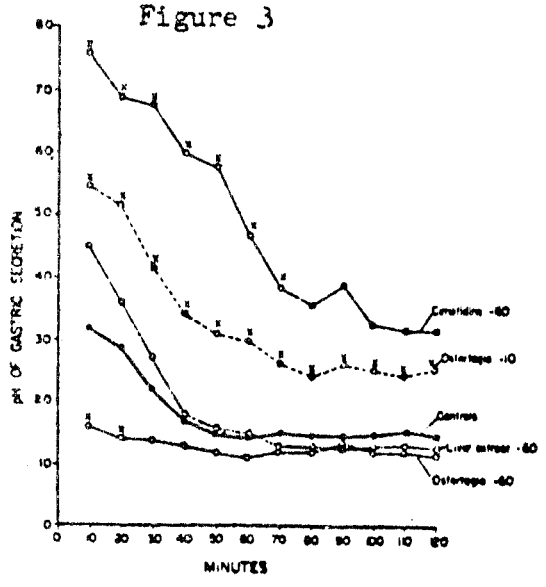

Figure 3. pH of gastric secretion as function of time in the rat stomach

EFFECT OF PROSTAGLANDIN F_2-ALPHA ON MOTILITY AND MINERAL ABSORPTION IN THE UTERUS AND INTESTINE IN RABBITS

Karen McDowell and Hugo Eiler

When $PGF_{2\alpha}$ is administered as an abortificant it causes strong uterine and intestinal contractions as well. A comparative study on the uterine and intestinal motility challenged by a myotonic drug, such as $PGF_{2\alpha}$, is necessary for a better understanding of uterine physiology. The study of the concentration of minerals in the organ walls, and the absorption rate of minerals placed in the intestinal and uterine lumena, under the effect of $PGF_{2\alpha}$ infusion, will provide information on the absorptive similarities between these two organs, the uterus and the intestine. The uterine and intestinal lumena normally are exposed to hypertonic concentrations of minerals which are then absorbed by the lumena. $PGF_{2\alpha}$ is a substance endogenous to the reproductive and intestinal tracts, and it is found naturally in the semen. Ultimately, this research will aid in understanding the process of fertilization, implantation and placental development, and hopefully to identify a source of tissue for uterine replacement.

1. The uterus and lower jejunum responded to $PGF_{2\alpha}$ infusion (i.v.) by increasing mean value - frequency, amplitude and total work of contraction. Colon contractions (mean value) decreased in frequency, but increased in amplitude to such an extent that total work mean value increased (Figures 1-3).

2. $PGF_{2\alpha}$ infusion caused significant removal of K from the luminal fluid of the colon, increase in Ca and Na concentration in the wall of the lower jejunum, and increase in Mg concentration in the wall of the colon.

3. Motility response to $PGF_{2\alpha}$ infusion was relatively similar in the uterus and jejunum.

4. Contrary to what happened in the intestine, mineral concentration in the uterine wall and rate of removal minerals from the uterine lumen was not affected by $PGF_{2\alpha}$ infusion.

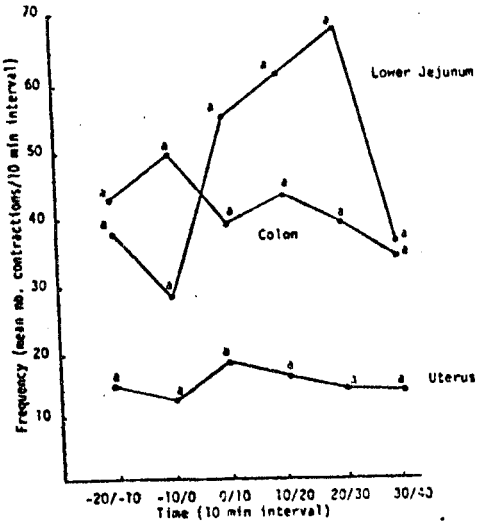

Figure 1. Frequency of contractions of uterus, jejunum, and colon.

[a]Similar superscripts represent no statistically significant differences among means within a tissue.

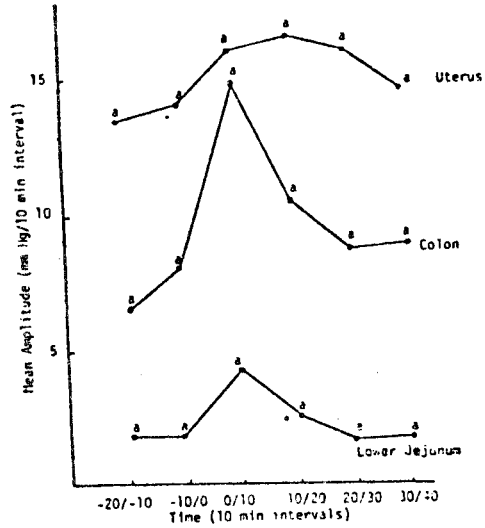

Figure 2. Amplitude of contractions of uterus, lower jejunum, and colon.

[a]Similar superscripts represent no statistically significant differences among means within a tissue.

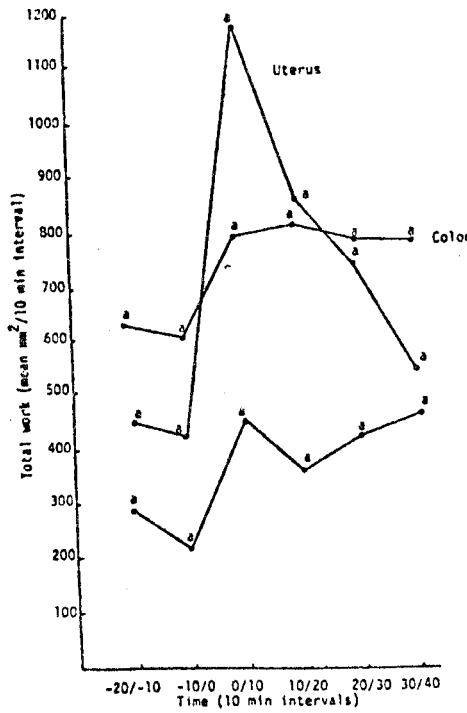

Figure 3. Total work of the uterus, jejunum, and colon.

[a]Similar superscripts represent no statistically significant differences among means within a tissue.

COMBINED DEXAMETHASONE SUPPRESSION AND COSYNTROPIN (SYNTHETIC ACTH) STIMULATION TEST IN THE DOG

H. Eiler and J. Oliver

Currently, adrenal gland disease in the dog is most commonly diagnosed on the basis of response (hydrocortisone (cortisol) secretion) to ACTH stimulation. The dexamethasone suppression test of adrenal gland function has been used infrequently. Because glucocorticoid secretion by neoplastic adrenal gland tissue usually is suppressed minimally by dexamethasone and is stimulated moderately by corticotropin, a combination of these testing procedures would be advantageous in diagnosing adrenal gland dysfunctional states.

The objective of the current study was to develop a combined dexamethasone suppression and cosyntropin (synthetic ACTH) stimulation procedure in the dog.

1. The following test procedure was used: (i) collect base-line plasma sample (0900 hours) followed by injection of dexamethasone (0.1 mg/kg, IM); (ii) collect second plasma sample 2 hours after dexamethasone (to evaluate suppression of plasma hydrocortisone concentration) followed by the injection of cosyntropin (0.5 U/kg, IV); and (iii) collect a third plasma sample 1 hour later to evaluate plasma hydrocortisone concentration after cosyntropin stimulation.

2. Treatment of dogs with dexamethasone (0.1 mg/kg, IM) resulted in total suppression (below assay sensitivity or < 10 ng/ml) of plasma hydrocortisone (cortisol) at postinjection hour (PIH) 2 in 100% of the dogs, whereas suppression was inconsistent at PIH 1 (Table 1). Cosyntropin (0.5 U/kg, IV) administration to normal or dexamethasone-suppressed dogs increased plasma hydrocortisone concentration 3.5 to 4.5 times base-line values at PIH 1, which was the time of maximal effect (Tables 2 and 3 and Figure 1).

3. The combined test concept for adrenal gland function, as developed in this laboratory, is valid, convenient (three sample collections; 3-hour period), and allows testing of adrenal gland response to dexamethasone suppression and ACTH stimulation in a single trial.

TABLE 1—Effect of a Single Suppressive (Adrenal Glands) Dose of Dexamethasone on Plasma Hydrocortisone Concentration in Dogs

Hours after dexamethasone (0.1 mg/kg, IM)	Dogs suppressed/ dogs treated	q*
Base line (0)	0/8	0
1	4/8	50
2	8/8	100
3	8/8	100
4	8/8	100

* Mean percentage decrease in plasma hydrocortisone concentrations when compared with base-line values.

TABLE 2—Effect of a Single Stimulative (Adrenal Glands) Dose of Cosyntropin on Plasma Hydrocortisone Concentration in Dogs

Hours after cosyntropin (0.5 U/kg, IV)	Dogs treated	Mean plasma hydrocortisone values (ng/ml ± SEM)
Base line (0)	6	22.9 ± 3.0[a]
0.5	6	86.5 ± 4.4[b]
1	6	120.9 ± 10.7[b]
2	6	96.5 ± 9.6[b]
4	6	24.0 ± 4.8[a]

[a,b] Similar superscripts indicate nonsignificance ($P > 0.05$), whereas nonsimilar superscripts indicate significant differences ($P < 0.05$).

TABLE 3—Effect of Cosyntropin Injection on Plasma Hydrocortisone Concentration in Dexamethasone-Suppressed (DMS) (Adrenal Glands) Dogs

Treatment group	Dogs treated	Mean plasma hydrocortisone values (ng/ml ± SEM)*	Range of plasma hydrocortisone values (ng/ml)
Control (base line)	17	32.2 ± 6.1[a]	< 10 to 57.7
DMS (0.1 mg/kg, IM)	17	< 10.0†[b]	...
DMS + cosyntropin (0.1 U/kg, IV)	6	72.2 ± 24.0[a,c]	10.0 to 144.7
DMS + cosyntropin (0.5 U/kg, IV)	6	132.2 ± 12.9[c]	80.5 to 162.8
DMS + cosyntropin (1.0 U/kg, IV)	5	109.9 ± 19.2[c]	82.9 to 184.0

* Time of sample collection was 1 hour after cosyntropin administration.
† Plasma hydrocortisone concentration was below assay sensitivity (10 ng/ml).
[a-c] Similar superscripts indicate nonsignificance ($P > 0.05$), whereas nonsimilar superscripts indicate significant differences ($P < 0.05$).

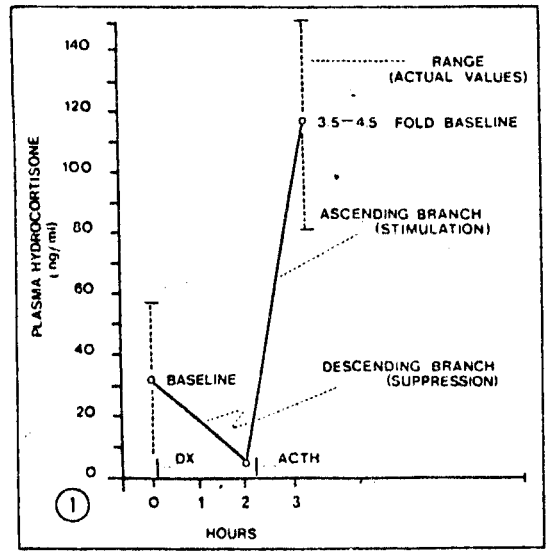

Fig 1—Combined dexamethasone and cosyntropin test results. Sequential dexamethasone (DX) and cosyntropin (ACTH) administration resulted in a V-shaped curve; the right, ascending branch of the V represents the cosyntropin stimulation phase, whereas the left descending branch of the V represents the dexamethasone suppression phase; thus, the test is referred to by the authors as the V-test.

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H. Eiler and J. Oliver

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3. The combined test concept for adrenal gland function, as developed in this laboratory, is valid, convenient (three sample collections; 3-hour period), and allows testing of adrenal gland response to dexamethasone suppression and ACTH stimulation in a single trial.

TABLE 1—Latency Between Prostaglandin $F_{2\alpha}$ Injection and Defecation, Emesis, and Micturition in the Dog

Group No.	Dosage mg/kg	Defecation (min)	Emesis (min)	Micturition (min)
1	0	(−)	(−)	(−)
2	0.022	12.50 ± 0.50[a] (40.0)*	(−)	11.5 ± 0.50[a] (40.0)
3	0.111	4.40 ± 0.39[b] (83.3)	(−)	(−)
4	0.222	9.00 ± 1.87[a] (100.0)	11.5 ± 2.45[a] (40.0)	(−)
5	0.333	4.80 ± 0.96[b] (87.5)	3.2 ± 0.37[b] (62.5)	5.5 ± 3.43[a,b] (25.0)
6	0.444	3.16 ± 0.70[b] (75.0)	5.7 ± 0.93[a] (87.5)	2.5 ± 0.49[b] (25.0)
7	0.555	4.50 ± 0.67[b] (60.0)	6.2 ± 1.42[a] (90.0)	(−)

* Percentage of responsive dogs.

Data are expressed as mean ± SEM for 5 to 10 dogs/group. − = no response; a,b,c = similar and different superscript indicate nonsignificant and significant ($P < 0.05$) differences respectively, among dosages under the same column.

TABLE 2—Recommended Dosage of $PGF_{2\alpha}$ (5 mg/ml) to be Used in the Dog

Body weight (kg)	For defecation (ml)	For emesis and defecation (ml)
5	0.11	0.44
10	0.22	0.88
15	0.33	1.33
20	0.44	1.76

To facilitate dosage calculation, use 0.1 ml of $PGF_{2\alpha}$/kg of body weight for vomition (and defecation) and one-fourth of this for defecation only.

TABLE 3—Respiratory Rate and Heart Rate Before and 1 Hour After $PGF_{2\alpha}$ Injection

Group No.	Dosage mg/kg	Respiratory rate before (min)	Respiratory rate 1 hour after injection (min)	Heart rate before injection (min)	Heart rate 1 hour after injection (min)
1	0	—	—	—	—
2	0.022	22 ± 1.0[a]	28 ± 3.2[a]	108 ± 12.3[a]	114 ± 11.2[a]
3	0.111	40 ± 2.9[a]	46 ± 6.5[a]	137 ± 11.9[a]	125 ± 14.7[a]
4	0.222	28 ± 2.1[a]	76 ± 9.0[a]	117 ± 7.1[a]	123 ± 6.3[a]
5	0.333	28 ± 2.5[a]	72 ± 10.4[a]	112 ± 6.9[a]	120 ± 4.2[a]
6	0.444	31 ± 2.3[a]	56 ± 8.6[a]	129 ± 10.1[a]	125 ± 9.3[a]
7	0.555	29 ± 2.0[a]	45 ± 4.8[a]	124 ± 4.7[a]	122 ± 8.8[a]

Data are expressed as mean ± SEM for five to ten dogs. a,b = similar and different superscripts indicate nonsignificant and significant ($P < 0.05$) differences respectively, within the same group; — = nonrecorded.

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